Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

CONTRACT NO. N68711-98-D-5713
CTO NO. 0072

FINAL
REMOVAL ACTION COMPLETION REPORT
November 30, 2007

DCN: ECSD-5713-0072-0004

**METAL DEBRIS REEF AND METAL SLAG AREA EXCAVATION SITES
PARCELS E AND E-2, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA**

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

CONTRACT NO. N68711-98-D-5713
CTO NO. 0072

FINAL

REMOVAL ACTION COMPLETION REPORT

November 30, 2007

METAL DEBRIS REEF AND METAL SLAG AREA EXCAVATION SITES
PARCELS E AND E-2, HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

DCN: ECSD-5713-0072-0004

TETRA TECH EC, INC
1230 Columbia Street, Suite 750
San Diego, CA 92101-8536

Ryan Ahlersmeyer, PG
TtEC Project Manager

Daryl DeLong
TtEC Radiation Safety Officer

TABLE OF CONTENTS

PAGE

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

PAGE

TABLE OF CONTENTS
(Continued)

PAGE

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Appendix A	Weather Data and Air Monitoring Report
Appendix B	Kick-Off Meeting Agenda
Appendix C	Well Destruction Form
Appendix D	Post-Excavation Chemical Sampling Results for Metal Debris Reef and Metal Slag Area
Appendix E	Backfill Material Review and Acceptance Documentation
Appendix F	Waste Data and Waste Manifests
Appendix G	Water Quality Monitoring Sampling Results
Appendix H	Survey Reports
Appendix I	Project Photographs
Appendix J	Field Change Request (FCR) Log and FCRs
Appendix K	Community Relations Documents
Appendix L	Validated Analytical Data Packages
Appendix M	On-Site Laboratory Systematic Sample Results
Appendix N	Off-Site Laboratory Sample Reports
Appendix O	Response to Comments

ABBREVIATIONS AND ACRONYMS

α	alpha
β^-	beta
%R	percent recovery
AM	Action Memorandum
ARAR	applicable or relevant and appropriate requirement
BA	Biological Assessment
BART	Bay Area Rapid Transit
Bay	San Francisco Bay
bgs	below ground surface
BMP	best management practice
BRAC	Base Realignment and Closure
C&T	Curtis and Tompkins, Ltd.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
^{137}Cs	cesium-137
CSO	Caretaker Site Office
CTO	Contract Task Order
cy	cubic yard
DCGL	derived concentration guideline level
DoD	Department of Defense
DON	Department of the Navy
DQA	Data Quality Assessment
DQO	Data Quality Objectives
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
ER-M	effects range-median
ESA	Endangered Species Act
FCR	field change request
FS	Feasibility Study
GPS	global positioning system

ABBREVIATIONS AND ACRONYMS
(Continued)

HazCat	Hazardous Categorization
HPALs	Hunters Point Ambient Levels
HPS	Hunters Point Shipyard
HRA	Historical Radiological Assessment
ICP	inductively coupled plasma
IR	Installation Restoration
IT	International Technology Corporation
ITSI	Innovative Technical Solutions, Inc.
LLMW	low-level mixed waste
LLRW	low-level radioactive waste
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	minimum detectable activity
MDR	Metal Debris Reef
mil	thousands of an inch
MPPEH	material potentially presenting an explosive hazard
MSA	Metal Slag Area
MS/MSD	matrix spike and matrix spike duplicates
msl	mean sea level
NaI	sodium iodide
NAVFAC SW	Naval Facilities Engineering Command, Southwest
NAVSEA	Naval Sea Systems Command
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NWT	New World Technology, Inc.
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
PjM	Project Manager
PM_{10}	particulate matter
PMO	Program Management Office

ABBREVIATIONS AND ACRONYMS
(Continued)

PPE	personal protective equipment
PQCM	Project Quality Control Manager
PRG	preliminary remediation goal
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
^{226}Ra	radium-226
RAB	Restoration Advisory Board
RAO	Removal Action Objective
RASO	Radiological Affairs Support Office
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RI	Remedial Investigation
ROC	radionuclide of concern
ROICC	Resident Officer in Charge of Construction
RPD	relative percent difference
RPM	Remedial Project Manager
RRO	Radiological Remedial Objective
RSD	relative standard durations
RSO	Radiation Safety Officer
SAP	Sampling and Analysis Plan
SDGI	Standard Data Gaps Investigation
SFRA	San Francisco Redevelopment Agency
SOP	Standard Operating Procedure
^{90}Sr	strontium-90
SVOC	semivolatile organic compound
SWPPP	Stormwater Pollution Prevention Plan
TCRA	time-critical removal action
TPH	total petroleum hydrocarbons
TPH-extractable	total extractable petroleum hydrocarbons
TPH-purgeable	total purgeable petroleum hydrocarbons

ABBREVIATIONS AND ACRONYMS
(Continued)

Triple A	Triple A Machine Shop, Inc.
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
TtEMI	Tetra Tech EM, Inc.
TtEC	Tetra Tech EC, Inc.
TtFW	Tetra Tech FW, Inc.
UXO	unexploded ordnance
VOC	volatile organic compound
yd^2	square yard

EXECUTIVE SUMMARY

This Removal Action Completion Report describes the implementation of a time-critical removal action undertaken at the Metal Debris Reef and Metal Slag Area located in Parcels E and E-2 at Hunters Point Shipyard, San Francisco, California. The Department of the Navy, Naval Facilities Engineering Command, Southwest, and the Radiological Affairs Support Office directed the time-critical removal action.

Hunters Point Shipyard is located on a long promontory in the southeastern part of San Francisco that extends into San Francisco Bay. At the start of World War II in 1939, the Department of the Navy took possession of the property and operated it as a shipbuilding, repair, and maintenance facility until 1974, when the shipyard was deactivated. From 1976 to 1986, the Department of the Navy leased the property to a private ship repair company. When that company ceased operations the Department of the Navy resumed occupancy through 1989. Since previous operations had left hazardous materials on site, Hunters Point Shipyard was placed on the National Priorities List in 1989 as a Superfund site.

Based on previous investigations, including results gathered during the sediment and soil data gaps investigation (Tetra Tech EM, Inc., 2005) and *The Final Historical Radiological Assessment, Volume II* (Naval Sea Systems Command, 2004) the Department of the Navy determined a time-critical removal action was warranted for the Metal Debris Reef and Metal Slag Area. The Final Historical Radiological Assessment listed cesium-137, radium-226, and strontium-90 as radionuclides of concern for these sites.

The time-critical removal action was conducted in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act and the National Oil and Hazardous Substances Pollution Contingency Plan. The time-critical removal action was conducted pursuant to the *Final Basewide Radiological Removal Action, Action Memorandum* (Department of the Navy, 2001a). A Project Work Plan (Tetra Tech EC, Inc, 2005a) was prepared and issued to outline the approach to conducting field work associated with this removal action (Tetra Tech EC, Inc, 2005a).

The Remedial Action Objectives included implementation and removal of contamination at Hunters Point Shipyard. The *Final Basewide Radiological Removal Action, Action Memorandum* (Department of the Navy, 2001a), documented the decision to undertake a time-critical removal action at areas with radiological contamination in soils, debris/slag, and buildings. The Remedial Action Objectives were to implement the *Final Basewide Radiological Removal Action, Action Memorandum* (Department of the Navy, 2001a) as follows:

- Remove low-level radioactive material to eliminate pathways of exposure to hazardous substances for surrounding populations and ecosystems due to erosion from tidal influence.
- Address non-radiological chemical contamination incidental to the radiological removal.
- Collect post-excavation samples, and to backfill and restore the shoreline.

The Remedial Action Objectives were planned to be achieved by excavation and removal of metal slag and debris, and other materials above the Radiological Remedial Objectives within the excavation boundary. In addition, limited trenching would be done outside the excavation boundary and if additional metal slag or debris was identified, it would be removed as well.

The major field activities associated with the time-critical removal action included clearing of vegetation; in-situ radiological surveys; excavation of soil; debris, drums and containers with unknown chemical contents; air monitoring; water quality sampling; ex-situ radiological screening; segregation of contaminated soil and debris; stockpiling of excavated soil and debris; post-excavation confirmation sampling; backfill placement and compaction with import materials; site restoration; and waste classification, storage, and disposal.

A grid system was established over the excavation area to track the required radiological surface surveying within the excavation boundary, control and record excavation progress, and assist in the collection of post-excavation samples. The excavation was performed in a series of lifts, to maximum depths ranging between three and six feet below ground surface. Radiological instruments were used to perform surface screening prior to removing each lift. Areas identified as having elevated gamma measurements present were remediated prior to excavation. The alternating screening and excavating cycle was continued until the excavation reached the final depth. Each grid was numbered to track the excavation depth and associated sampling. Maximum depth of excavation in each grid was variable, and was dependent on observations conducted during excavation activities. The sample depth associated with the post-excavation chemical characterization samples is reflective of the maximum depth of the appropriate grids.

Upon completion of backfilling and final grading of all disturbed areas the Metal Slag Area was revegetated using hydroseeding. At Metal Debris Reef, the pads used to screen excavated soils were left in place for future use; therefore; there was no hydroseeding conducted at the site. Revegetation was performed to prevent long-term surface erosion and prevent increased sedimentation to the San Francisco Bay.

The originally estimated volume of soil, metal slag, and debris to be removed at Metal Debris Reef was approximately 8,500 cubic yards, however the final amount excavated was 11,200 cubic yards. The original estimated volume of soil and metal slag at Metal Slag Area was approximately 5,500 cubic yards. Based on the trenching, the Metal Slag Area excavation boundary was extended to the east and west increasing the total volume removed to 8,200 cubic yards.

The effectiveness of the time-critical removal action was established by evaluating the post-excavation samples. The evaluation included a comparison of the post-excavation results to the appropriate radiological remedial objective. For Metal Debris Reef, all but two samples were below the radiological remedial objectives. Both were systematic samples.. One sample exceeded the cesium-137 release criteria and 1 sample exceeded the radium-226 release criteria. At Metal Slag Area, most samples were below the Radiological Remedial Objectives. For the systematic grid samples, all but four samples obtained were below the Radiological Remedial Objectives. Two samples exceeded the cesium-137 release criteria and 2 samples exceeded the radium-226 release criteria. None of the elevated samples gives reasonable cause to presume that widespread contamination is present at Metal Debris Reef/Metal Slag Area. In addition, 163 point sources and pieces of radioactively contaminated debris were removed during the excavations at Metal Debris Reef/Metal Slag Area.

The Remedial Action Objectives for radiological materials, which were based on the *Final Basewide Radiological Removal Action, Action Memorandum* (Department of the Navy, 2001a), were achieved for both sites. Any remaining radiological materials are now under a cap of clean soil, thereby eliminating pathways of exposure to hazardous substances for surrounding populations and ecosystems. Non-radiological chemical contamination encountered during the radiological removal was removed. Post-excavation chemical characterization samples were collected and are available to aid in refining the current understanding of chemical contamination at and adjacent to the Metal Debris Reef/Metal Slag Area sites.

Recommendations for actions at or adjacent to the Metal Debris Reef and Metal Slag Area sites include the following:

For Metal Debris Reef:

- Evaluate all data (both chemical and radiological) collected during and subsequent to removal action activities with respect to the contaminant distribution as presented in the Parcels E and F conceptual site models. This evaluation should include an assessment of remedial options for Installation Restoration site 2 and Areas 8, 9, and 10 in Parcel F.
- Continue to perform assessments of the stability of shoreline materials (i.e., sand) and develop a contingency plan in the event that significant erosion or migration occurs.
- Evaluate the future need and viability of the screening pad currently secured at Metal Debris Reef.

- Continue to inspect and maintain shoreline areas as part of the storm water pollution and protection program.

For Metal Slag Area:

- Evaluate all data (both chemical and radiological) collected during and subsequent to removal action activities with respect to the contaminant distribution as presented in the Parcels E-2 and F conceptual site models. This evaluation should include an assessment of the remedial options for Installation Restoration site 01/21, South Basin, the Ship Shielding Range and adjacent soil berms, and the remainder of the panhandle area.
- Continue to perform assessments of the stability of shoreline materials (i.e., sand) and develop a contingency plan in the event that significant erosion or migration occurs.
- Perform the wetlands mitigation as presented in the project work plan. This mitigation is planned to be performed as part of a larger, comprehensive mitigation effort discussed in the Installation Restoration site 01/21 Remedial Investigation/Feasibility Study

1.0 INTRODUCTION

This Removal Action Completion Report describes the implementation of a time-critical removal action (TCRA) undertaken at the Metal Debris Reef Area (MDR) and the Metal Slag Area (MSA) within Parcels E and E-2, located at Hunters Point Shipyard (HPS), San Francisco, California (Figure 1-1). The Department of the Navy (DON), represented by the Base Realignment and Closure (BRAC) Program Management Office (BRAC PMO West), Naval Facilities Engineering Command, Southwest Division (NAVFAC SW), and the Radiological Affairs Support Office (RASO), directed this removal action. The removal action was conducted in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This removal action was performed under Contract No. N68711-98-D-5713 and Contract Task Order (CTO) No. 0072.

Hunters Point Shipyard's operational history and subsequent investigative data indicated that MDR and MSA contained radioactive contamination that required a response action. This decision is documented in the *Final Basewide Radiological Removal Action Memorandum* (referred to hereafter as the Action Memorandum [AM]) (Department of the Navy [DON], 2001a), which was created to direct TCRAs within areas throughout HPS that contain localized radioactive contamination. The data gathered during site characterization activities from June through September 2004, the Phase V radiological investigations in 2003, and the Parcel E shoreline investigation in June and July 2001 were used to implement this removal action.

The TCRA was conducted in accordance with the requirements of CERCLA and NCP. DON submitted all necessary notifications prior to mobilization. Local permits were not required, because the TCRA was performed in accordance with Section 121(e) of the CERCLA. However, the substantive requirements for the local permits were met.

This Removal Action Completion Report describes the scope and the specific activities involved in the implementation of the TCRA for MDR/MSA. The TCRA was implemented to limit the human and ecological receptor exposure, and to eliminate the potential threat posed by future migration and/or off-site release of these contaminants. Such a release could occur as a result of erosion, weathering, or seismic events. The major field activities associated with the time-critical removal action included clearing of vegetation; in-situ radiological surveys; excavation of metal slag and debris and associated sediment; ex-situ radiological screening; segregation of contaminated soil and debris; stockpiling of excavated soil and debris; post-excavation confirmation sampling; backfill and shoreline protection; site restoration; and waste classification, storage, and disposal.

1.1 OBJECTIVES OF THE TCRA

The Removal Action Objectives (RAOs) included implementation and removal of contamination at MDR/MSA. The AM (DON, 2001a) for HPS documented the decision to undertake a TCRA at areas with radiological contamination in soils, debris/slag, and buildings. The RAOs were to implement the AM (DON, 2001a) as follows:

- Remove low-level radioactive material to eliminate pathways of exposure to hazardous substances for surrounding populations and ecosystems due to erosion from tidal influence.
- Address non-radiological chemical contamination incidental to the radiological removal.
- Collect post-excavation samples and backfill and restore the shoreline.

The TCRA action described in this document is part of a larger overall effort by the DON to remediate HPS. Activities being performed as part of this TCRA were coordinated with remediation activities throughout Parcels E and E-2. Materials left in place at the conclusion of this TCRA will be evaluated during the Feasibility Studies (FSs) for these parcels.

1.2 REPORT ORGANIZATION

This Removal Action Completion Report has been structured to provide details on the major aspects of the TCRA at MDR/MSA. It is organized as follows:

- Section 1.0 discusses the objectives of the TCRA, the report organization and the project timeline.
- Section 2.0 discusses the site description and background, the physical characteristics, previous investigations, the nature and extent of contamination, and a summary of the AM driving this TCRA.
- Section 3.0 discusses pre-construction site activities.
- Section 4.0 discusses field activities, including the excavation, radiological findings, and chemical and radiological sampling results.
- Section 5.0 discusses backfill placement, compaction and grading, topographic survey, demobilization, completion inspections, the photographic log, and field changes to the *Final Removal Action Design and Implementation Work Plan Metal Debris Reef and Metal Slag Areas* (referred to hereafter as the Work Plan [Tetra Tech EC, Inc. (TtEC), 2005a]).
- Section 6.0 discusses waste characterization data and disposal and/or recycling of wastes generated during the excavation activities.
- Section 7.0 discusses the radiological data and results.
- Section 8.0 discusses the effectiveness of the removal action.

- Section 9.0 assesses data quality assurance (QA) and quality control (QC).
- Section 10.0 contains community relations activities conducted during the project.
- Section 11.0 contains the report recommendations.
- Section 12.0 contains a list of references.
- Appendix A contains the weather data collected during the project.
- Appendix B contains the kick-off meeting agenda.
- Appendix C contains the well destruction forms.
- Appendix D contains the results of the chemical post-excavation sampling results.
- Appendix E contains the backfill material review and acceptance documentation.
- Appendix F contains the results of the waste data and waste manifests.
- Appendix G contains water quality monitoring sampling results.
- Appendix H contains the survey reports from the project.
- Appendix I contains pertinent project photos.
- Appendix J contains the field change requests for the project.
- Appendix K contains community relations documents for the project.
- Appendix L contains the validated laboratory data packages for the project.
- Appendix M contains the on-site laboratory post-excavation systematic sample data.
- Appendix N contains the off-site laboratory post-excavation sample data.

1.3 TIME LINE

Mobilization for the TCRA began in April, 2005 and the actual excavation activity began in May 2005. The majority of the excavation was completed by September 2006; however the extended excavation portion at MSA was not completed until May 2007. The original project duration was extended for reasons including, but not limited to, significant weather delays and the need to excavate beyond the original excavation boundaries.

2.0 SITE BACKGROUND AND HISTORY

This section presents the facility description and background, the physical characteristics of the MDR/MSA, a summary of previous investigations conducted at MDR/MSA, the nature and extent of contamination, and a summary of the AM (DON, 2001a).

2.1 FACILITY DESCRIPTION AND BACKGROUND

HPS is located on a long promontory in the southeastern part of San Francisco that extends east into San Francisco Bay. Presently, HPS encompasses approximately 848 acres, of which approximately 416 acres are on land. The land portion of HPS was purchased by the DON in 1939 and leased to Bethlehem Steel Corporation. At the start of World War II in 1941, the DON took possession of the property and operated it as a shipbuilding, repair, and maintenance facility until 1974. The DON deactivated HPS in 1974. From 1976 to 1986, the DON leased HPS to Triple A Machine Shop, Inc. (Triple A), a private ship repair company. In 1986, Triple A ceased operations and the DON resumed occupancy through 1989. In 1991, HPS was placed on the DON's BRAC list and its mission as a DON shipyard ended in April 1994.

HPS was divided into six parcels, Parcels A through F. In November 2004, Parcel A was transferred to the City and County of San Francisco. In 2004, the DON subdivided Parcel E, creating Parcel E-2. MDR is located in Parcel E and MSA within Parcel E-2, as shown in Figure 1-1.

2.1.1 Operating History

The DON operated a 1-acre open burn disposal area in what is now known as Installation Restoration (IR) Site 02 Southeast adjacent to MDR Approximately 23,000 tons of domestic garbage and refuse, including metal debris, were burned at the Open Burn Disposal Area (Tetra Tech EM, Inc. [TtEMI] et al., 1997). The reef appears to have been formed from material that was burned at the Open Burn Disposal Area and from material disposed of from the metal foundry (Building 241) and the smelter (Building 408). The reef consisted of concrete debris, metal scrap, and metal slag with radioactive anomalies. MDR is primarily below the mean high water (MHW) level and is located in a relatively strong current area. The reef was in various states of oxidation.

MSA, located in Parcel E-2, was composed of wastes suspected to have originated from the metal foundry (Building 241) and the smelter (Building 408) when the shipyard was active. Waste in MSA included industrial debris and metal slag with radioactive anomalies. The slag was discontinuous and partially covered during high tide.

2.1.2 Topography/Structures

The topography of MDR/MSA is relatively flat, with surface elevations of generally less than 10 feet above mean sea level (msl). The shoreline area generally consists of riprap containing rock, concrete, and other debris, with relatively steep slopes to the bay as well as mudflats and sandy beaches. There are no structures at MDR/MSA.

2.1.3 Current Land Use and Future Land Use

The current and the planned future use of MDR/MSA is as "open space" area, which was identified in the San Francisco Redevelopment Agency (SFRA) Reuse Plan (SFRA, 1997).

2.2 PHYSICAL CHARACTERISTICS

This section presents the physical characteristics of MDR/MSA which include the geology, hydrogeology, surface hydrology, and climate conditions.

2.2.1 Geology

The geologic units within the project area, from the surface downward, consist of artificial fill, undifferentiated upper sand deposits, Bay Mud deposits, undifferentiated sedimentary deposits, and the Franciscan Assemblage. The artificial fill consists of heterogeneous material, predominantly dark grayish-brown to light olive-brown silty sand with gravel. The lower boundary of the artificial fill is irregular, suggesting stream channels and dredged areas cut into the sediments. Landfill debris is found within the artificial fill. The undifferentiated upper sands are Holocene estuarine and alluvial deposits consisting of yellowish-brown sand with clay. The undifferentiated upper sands mostly overlie, but in places are interbedded with the Bay Mud. This unit occurs sporadically as isolated lenses. The Bay Mud deposits consist of predominantly Holocene, estuarine, dark gray to dark greenish-gray fat clay, with varying proportions of sand and/or silt and trace amounts of shell fragments. This stratigraphic unit appears to increase in thickness from the southeast toward the northwest. The undifferentiated sediments consist of interbedded clay, silt, and sand and are the oldest unconsolidated sedimentary unit. The undifferentiated sediments consist of two or three relatively thick, laterally continuous layers of sand and silty or clayey sand, which are separated by laterally continuous layers of silt and clay. The bedrock surface, consisting of Franciscan Assemblage serpentinite, dips from the northeast to the southwest toward the Bay. It is estimated to exist at depths ranging from approximately 200 to greater than 250 feet below msl. Serpentinite is a low-grade metamorphic rock with serpentine minerals derived from alteration of the ultramafic minerals olivine and pyroxene. Serpentinite typically contains naturally high concentrations of metals. The bedrock has been subjected to intense tectonic activity resulting in a high degree of folding, faulting, and metamorphism.

2.2.2 Hydrogeology

Hydrogeologic units within the project area consist of the A-aquifer, Bay Mud aquitard, B-aquifer, and the bedrock water-bearing zone. The A-aquifer consists of heterogeneous artificial fill and undifferentiated upper sand deposits. The Bay Mud aquitard appears to be laterally continuous beneath the sites. The B-aquifer consists of undifferentiated sedimentary deposits, but was not encountered during the work at MDR/MSA. The estimated saturated thickness of the B-aquifer is greater than 200 feet. The bedrock water-bearing zone was also not encountered during work at MDR/MSA. The bedrock hydrogeologic unit is estimated to occur at depths ranging from approximately 200 to greater than 250 feet below msl.

The groundwater levels in the A-aquifer in MDR/MSA have been found to range from approximately 1 to 15 feet below ground surface (bgs). Groundwater levels are generally higher during the wet season (December to April). The A-aquifer is under unconfined conditions. The results of the 1992 and 1996 tidal influence studies indicate that the groundwater elevations in the A-aquifer within approximately 300 feet of the shoreline, which includes most of the MDR/MSA, are influenced by the tidal fluctuations of the Bay.

Groundwater in the A-aquifer flows predominantly to the south in the area of MDR. Groundwater in the A-aquifer flows predominantly southeast in the area of MSA.

2.2.3 Surface Hydrology

Stormwater is conveyed from MDR/MSA by surface sheet-flow. MDR drains from the east to the west. MSA drains from the northwest to the southeast. No existing stormwater drainage system or drainage control features were located at the sites.

2.2.4 Climate Conditions

A weather station was maintained on HPS during this project. Measurements were taken every half hour of temperature, wind speed, wind direction, and rainfall. The pertinent weather data collected are included in Appendix A.

Rainfall affected the excavation work in a number of ways. During the excavation of MDR/MSA more than eighteen inches of rain fell at HPS. The rainfall affected the effectiveness of radiological equipment and vehicle mobility on the site. During wet conditions radiological screening was halted. In addition, due to HPS's location in the Bay Area, wind speeds could be very high and variable throughout the day. Wind speed and direction affected dust controls and prompted additional health and safety measures.

2.3 PREVIOUS INVESTIGATIONS

Previous investigations have identified radioactive materials and chemical contaminants in Parcels E and E-2. Results from site investigations as well as the operational history of Parcel E are contained within the Final Historical Radiological Assessment (HRA), Volume II (NAVSEA, 2004).

The following investigations were performed prior to the work performed under the Work Plan (TtEC, 2005a):

- 1992 – Phase I radiological investigation
- June and July of 2001 – shoreline gamma surveys
- March 2002 to February 2003 – data gaps investigation
- June to September of 2004 – site characterization

Each of these investigations covered both MDR and MSA. Results of these investigations are summarized in Section 2.4.

The Phase I Radiological Investigation was conducted in two phases. Phase I (1) was conducted in 1991 and consisted of air monitoring. Phase I (2) was conducted in 1992 and was initiated to confirm the nature and surficial extent of radium-bearing devices in Parcel E.

In 2001 a characterization survey of the Parcel E shoreline was performed. Gamma scans were conducted over pre-positioned grids. The shoreline survey encompassed areas within 50 feet of the mean tide line with each grid assigned a unique identifier.

From March 2002 to February 2003, the DON, BRAC PMO West conducted a data gaps investigation at Parcels E and E-2 at HPS. During the Standard Data Gaps Investigation (SDGI), chemical data were collected from the Parcels E and E-2 shoreline and onshore areas to assess potential contaminant source areas. The DON will present the data analysis and evaluation of the SDGI results in the Draft Revised Remedial Investigation (RI) Report for Parcel E and in the Draft RI and FS Report for Parcel E-2 upon their completion. The post-excavation sampling data from areas included in MDR/MSA TCRA described in this report will be included and considered in the FS for Parcel E and the RI/FS for Parcel E-2.

Additional site characterization was conducted at MDR/MSA from June through September 2004. These data and the historical data where used to develop the Work Plan (TtEC, 2005a). The characterization activities included:

- Topographic and bathymetric surveys
- Marine geophysics surveys
- Landside geophysics surveys

- Environmental resources surveys
- Vibracoring and sonic drilling and sampling activities
- Downhole geophysics
- Sample analysis

The 2004 sediment characterization survey included several components including intertidal sonic drilling and sample collection and marine vibracoring and sample collection. Surface gamma surveys were performed at boring locations to prevent potential contamination of boring equipment. Additional surveys were performed on each core section as it was removed.

In addition to the gamma survey, samples were collected for radiological analysis during the sediment characterization survey. Three samples were collected from each core and were analyzed on site using gamma spectroscopy. Ten percent of the samples analyzed on site were sent off site for gamma spectroscopy, gross alpha, gross beta, isotopic plutonium, isotopic uranium, and strontium-90 (^{90}Sr).

2.4 NATURE AND EXTENT OF CONTAMINATION

This sections details both the chemical and radiological analysis of the previous investigations discussed in Section 2.3.

2.4.1 Chemical Contamination

A data gaps investigation was conducted at Parcels E and E-2 at HPS between March 2002 and February 2003. The investigation indicated that sediment near MDR contained metals, polychlorinated biphenyls (PCBs), and pesticides at concentrations exceeding the Hunters Point Ambient Levels (HPALs), Preliminary Remediation Goals (PRGs), or the effects range-median (ER-M) sediment screening criteria (TtEMI, 2002). The metals detected in sediment samples from MDR at concentrations exceeding the HPALs, PRGs, or ER-Ms were antimony, arsenic, beryllium, cadmium, cobalt, copper, lead, manganese, mercury, molybdenum, nickel, silver, vanadium, and zinc, as presented in the Work Plan (TtEC, 2005a). The sample locations are shown on Figures 2-1 and 2-2 for MDR and MSA, respectively.

The Parcel E shoreline investigation data for MSA show that sediment at MSA contains metals at concentrations exceeding the HPALs, PRGs, or ER-M sediment screening criteria. The metals detected in sediment samples from MSA at concentrations exceeding the HPALs, PRGs, or ER-Ms were antimony, arsenic, copper, lead, manganese, molybdenum, and zinc, as presented in the Work Plan (TtEC, 2005a).

2.4.2 Radiological Contamination

The Phase I investigation revealed one elevated reading in the Open Burn Disposal Area and five elevated readings by Berth 36 (see Figure 2-3) at MDR. The Phase I investigation revealed five elevated readings at MSA (see Figure 2-4). The results of this investigation indicated that radium-containing devices may be present in MDR and MSA. Other sources of radiation encountered may be in the form of sandblast grit. HPS used sandblast grit to decontaminate ships involved in atomic weapons testing and may have disposed of some of the grit at MDR and MSA [Naval Sea Systems Command (NAVSEA), 2004].

The 2001 radiological survey revealed areas of radiation at greater than twice the background concentration in both MDR and MSA. Figures 2-3 and 2-4 show the boring locations where radiological samples were collected during the 2004 sediment characterization survey. No elevated radiological readings were identified at the surface of the boring locations and similarly no cores exhibited radiological readings above background when analyzed by gamma survey. Sample results indicated elevated Cesium-137 (^{137}Cs) activity in one sample from MDR and three samples from MSA. Tables 2-1 and 2-2 present the results of the sediment characterization radiological sampling and highlight samples that exceeded the derived concentration guideline levels (DCGLs) for a given radionuclide of concern (ROC).

Additional site characterization of sediment near MDR and MSA was performed between June and September of 2004. A total of 105 radiological samples were collected from offshore and onshore borings: from MDR, 24 marine sediment and 30 land samples were collected; and from MSA, 21 marine sediment and 30 land samples were collected. At MDR, one sample had elevated radioactivity for ^{137}Cs. At MSA, three samples had elevated radioactivity for ^{137}Cs. An evaluation of concentrations in sediment below the slag and trace slag layers was conducted to assess material to be uncovered during remediation. The other characterization activities conducted were used in the design of the remedial action.

2.5 ACTION MEMORANDUM

The TCRA at MDR and MSA was conducted pursuant to the AM (DON, 2001a) which documented, for the Administrative Record, the DON's decision to undertake the TCRA at the site due to radioactive contamination in soils and debris. The AM (DON, 2001a) presented the regulatory framework under which the TCRA was performed and identified chemical cleanup goals, Radiological Remedial Objectives (RROs), and specific remedial activities for the TCRA. The RROs were modified during the execution of the TCRA to correspond with the lower release criteria as presented in the revised AM (TtEC, 2006).

2.5.1 Radiological Remedial Objectives and Release Criteria

The cleanup goals for buildings, structures, material, and land areas at HPS are listed in Table 2-3. Release criteria for equipment and material are taken from Atomic Energy Commission (AEC) Regulatory Guide 1.86 (AEC, 1974). Cleanup goals for soils are taken from the U.S. Environmental Protection Agency's (EPA's) (risk-based) PRGs for two future-use scenarios or from negotiated agreements with EPA.

2.5.2 Derived Concentration Guideline Levels

Derived levels, known as DCGLs, are presented in terms of residual radiation activity found in soils. DCGLs applicable to soils are expressed in units of picocuries per gram (pCi/g). DCGLs refer to average levels of radiation or radioactivity above appropriate background levels. Regulatory agencies establish radiation dose standards based on risk considerations and scientific data relating dose to risk. Residual levels of radioactive material that correspond to allowable radiation dose standards are calculated by analysis of various pathways and scenarios (e.g., direct radiation, inhalation, ingestion, etc.) through which exposures could occur. Using DCGLs as part of the radiological release process assures that residual radioactivity in an area will not result in individuals being exposed to unacceptable levels of radiation or radioactive materials.

The development of DCGLs is often an iterative process, where the DCGLs selected or developed are modified as additional site-specific information is obtained. The DCGL values used for this work were selected to be equal to the RROs for the HPS site. These values for soils, taken from EPA's (risk-based) PRGs for two future-use scenarios, or from negotiated agreements with regulators, are presented in Table 2-3. In developing these values, the DON compared the Nuclear Regulatory Commission (NRC) and EPA release criteria and the more restrictive value was used.

2.5.3 DCGL Modeling

The intent of this report is not to achieve unrestricted release for the MDR and MSA. Per the AM (DON, 2001a), the goal of this TCRA with regard to radiological contaminants was to remove contaminants above the RROs. Since unrestricted release is not being sought, no further modeling is needed.

3.0 PRE-CONSTRUCTION ACTIVITIES

This section presents the pre-construction activities that were conducted at MDR/MSA. Pre-construction activities included environmental resources surveying, pre-mobilization conference, field mobilization, initial radiological surface screening, site support area preparation, utility survey, environmental protection measures, stormwater and erosion control, and fugitive dust control.

3.1 ENVIRONMENTAL RESOURCES SURVEYING

In 2004, preliminary investigations were performed within Parcel E to determine the presence of habitat for plant and wildlife species protected under the Migratory Bird Treaty Act, California Fish and Game Code, and state and federal Endangered Species Acts (ESAs). At that time, Parcel E had not been subdivided into Parcels E and E-2. Findings of these preliminary investigations are presented in the *Final Biological Assessment* (BA) (Tetra Tech FW, Inc. [TtFW], 2004a). The BA (TtFW, 2004) conducted to address ecological risks associated with three concurrent TCRAs executed within the boundaries of Parcel E and E-2, including MDR/MSA.

The BA (TtFW, 2004) identified eight ESA federally protected species, including four fish, three avian species, and one mammalian species as having the potential to be found in the vicinity of the TCRA project areas. Although the preliminary investigations determined that the removal actions were not likely to affect the eight ESA protected species, potential habitat, albeit marginal to submarginal, existed within the vicinity of the project area. Project activities were not deemed to have a critical impact on habitat for the protected species. Therefore, in the unlikely scenario that any of the eight ESA species were detected during project implementation, the BA (TtFW, 2004) stated that a biological monitor would be on site during intrusive site activities, mobilization, and demobilization.

In accordance with the BA (TtFW, 2004a) and the Work Plan (TtEC, 2005a), prior to mobilization, a qualified wildlife biologist performed an environmental resources survey. The environmental resources survey was conducted in March 2005. The survey identified no special-status species residing within the limits of work. As a precautionary measure, a wildlife biologist remained on site during intrusive activities. During the course of the field work, there were no sightings or biological issues preventing excavation activities.

The in-water excavation work would have been completed during the "In Water Work Window" for work in the San Francisco Bay Area at MDR and MSA; however, because of schedule delays on the projects, it was necessary to work outside this time window. In consultation with the National Oceanic and Atmospheric Administration it was concluded that the impacts from the excavation were "DISCOUNTABLE." However, total habitat avoidance was not practical; therefore the projects were deemed to fall under the "MAY AFFECT, BUT ARE NOT LIKELY TO ADVERSELY AFFECT" the local fish species. Therefore, it was possible to complete the excavation at MDR and MSA outside of the In Water Work Window.

3.2 PRE-MOBILIZATION CONFERENCE

Prior to mobilization, a Kick-off Meeting was held on March 23, 2005, for three TCRA sites that were to be executed concurrently in Parcels E and E-2 at HPS, namely PCB Hot Spot, IR-02 Northwest and Central, and MDR/MSA. The attendees included DON and TtEC personnel, as well as pertinent subcontractors and their project managers. During the Kick-off Meeting, site-specific activities and tasks required for the TCRAs were reviewed. Pre-construction mobilization requirements were validated prior to initiation of the TCRA fieldwork. The meeting agenda is included in Appendix B.

Prior to the kick-off meeting, and in accordance with TtEC policies, TtEC held an internal operational readiness review on April 5, 2005, with all pertinent TtEC employees and subcontractor representatives. This meeting included a review of health and safety, project, and waste management procedures for the project activities. Additional follow-up meetings were conducted during the course of the project as necessary, specifically after periods of inactivity in the field, or when new procedures were developed.

Prior to commencement of mobilization activities, base entry badges for employees were obtained by delivering a list of field personnel to SFRA. To obtain required vehicle decals, a list of personally owned vehicles, along with the required insurance and registration documentation, were provided to the HPS Police Department.

3.3 INITIAL RADIOLOGICAL SURFACE SCREENING

Prior to mobilization of heavy equipment, an initial radiological surface survey of MDR/MSA for gamma radiation was completed. The area of the survey extended beyond the excavation area and included all laydown areas at each site. The purpose of the radiological surface survey was to identify surface and near-surface (to a depth of 30.5 centimeter [cm] [12-inch (in)] bgs) radioactive materials for removal prior to excavation activities to prevent the spread of contamination by the project equipment.

The preliminary radiological surface survey consisted of a high-density gamma scan performed over a 50-foot (ft) by 50 ft grid system with the use of sodium iodine (NaI) detectors supported by global positioning system (GPS) equipment for locations. The high-density survey process resulted in a 100 percent scan survey. Once suspected radioactive material was confirmed, GPS/grid coordinates were recorded and the location marked or flagged. Radiological support personnel then removed the radioactive material, including the soils from within 1 foot in all directions of the material, from the marked location using a small backhoe fitted with a smooth blade bucket and/or hand-digging tools. This method was followed until all radiological materials identified during the initial radiological surface survey were removed.

For additional information regarding the removal of identified radiological materials and a summary of radiological findings see Section 4.0. Radiological findings consisted of solids less than 5 pounds, buttons, debris, devices, dials, rocks, one glass tube, and wire.

3.4 SITE SUPPORT AREA PREPARATION

Prior to the mobilization of equipment and materials to MDR/MSA, project support areas were established to provide for the temporary storage of tools, equipment, and materials. Support areas were also established outside the fenced-in area of each site to provide employee vehicle parking and break areas.

3.5 MOBILIZATION

Mobilization activities included site preparation, movement of equipment and materials to the site, a topographic survey, and orientation and training of field personnel. Throughout the months leading up to field mobilization, representatives from the Resident Officer in Charge of Construction (ROICC), the RASO, the Caretaker Site Office (CSO) and the DON Remedial Project Manager (RPM) were notified regarding the planned schedule and commencement of ground-breaking excavation activities.

Upon receipt of the appropriate records and authorizations, field personnel, temporary facilities, and required construction materials were mobilized to MDR/MSA. The temporary facilities included restrooms, security fencing, runoff controls, and secure Connex storage boxes for short- and long-term storage of materials. Construction materials mobilized to the site allowed for the building of the lined dewatering/radiological screening pad, large debris holding pad, low-level radioactive waste (LLRW) and low-level mixed waste (LLMW) holding pad, stockpile pad, equipment decontamination pad, and soil dewatering pad. At MSA, the road was graded to improve heavy equipment access to the site.

Prior to mobilizing heavy equipment to the area, the entire surface within the work area (including excavation and laydown areas) was screened for gamma-emitting radioactive sources, as described in Section 3.3. To facilitate this, vegetation at MDR/MSA was cleared and grubbed, before screening started. The vegetation was managed as part of an ongoing study of vegetation at HPS (TtEC, 2005a; 2005b).

Once the surface of the area was cleared of radiological materials, equipment mobilization was initiated and the entire landside of the construction area of MDR/MSA was enclosed with temporary 6-foot security fencing. A lined dewatering/radiological screening pad, large debris holding pad, LLRW and LLMW holding pad, stockpile pad, equipment decontamination pad, and soil dewatering pad were constructed using a double-liner design. For information on site layout see Figures 3-1 and 3-2.

The first layer of the 20-thousands of an inch (mil) liner was placed directly on the ground surface. A 6-inch layer of Bay Area Rapid Transit (BART) soil was then placed over the first layer of liner. A second layer of 20-mil liner was placed over the BART soil layer. A final top 6-inch layer of BART soil was then placed on top of the second liner. As a result, any activities performed on the pad areas occurred on the top soil layer, not directly on the liner, thus protecting the liner from puncture. Prior to constructing the pads, the area was cleared of rocks, debris, and other items in order to prevent puncture of the liner material. The dewatering pad was constructed with sufficient slope such that all runoff was conveyed to a sump where the water collected and then was pumped into a holding tank as necessary. The pad areas were bermed with sandbags and hay bales.

A decontamination pad was constructed adjacent to the exit of the site using a design similar to the pads described above, with the exception of the use of rock and gravel as liner cover construction material instead of BART soil. This allowed for decontamination water to filter through to a collection sump. The decontamination pad was bermed with sandbags, and collected runoff was pumped from the sump into a large holding container for sampling, characterization, and appropriate disposal (see Section 6.3).

Stormwater controls addressing appropriate best management practices (BMPs) were installed around the pads. The stormwater controls were implemented in accordance with the Stormwater Pollution Prevention Plan (SWPPP) in the Work Plan (TtEC, 2005a).

3.6 UTILITY SURVEY

Topographic and bathymetric surveys, marine geophysics surveys, landside geophysics surveys, and downhole geophysics were conducted as part of the additional site characterization conducted in July 2004. Additionally, existing as-built drawings of the area surrounding MDR/MSA were reviewed. The results of the additional site characterization survey activities were compared to the available as-built drawings to determine the utilities present. Identified underground features within the vicinity of the proposed excavation areas were marked using appropriately colored paints, stakes, and flags.

3.7 ENVIRONMENTAL PROTECTION MEASURES

An Environmental Protection Plan (EPP) was developed and implemented during project activities (Appendix A of the Work Plan [TtEC, 2005a]). The EPP outlined the environmental compliance procedures and regulatory, procedural, and training requirements required for conducting the TCRA field activities. Applicable or relevant and appropriate requirements

(ARARs) pertaining to hazardous waste management, air emissions, stormwater, fugitive dust, floodplains and wetlands, and endangered species were also identified in the EPP along with required control measures.

A SWPPP was included in the Work Plan (TtEC, 2005a) that addressed the appropriate BMPs for controlling stormwater at MDR/MSA. The SWPPP was developed in accordance with State Water Resources Control Board requirements. Because the field activities were regulated under CERCLA, a general National Pollutant Discharge Elimination System (NPDES) stormwater construction permit was not required, although the substantive requirements of the NPDES permit were met.

3.7.1 Best Management Practices

Prior to site activities, a sandbag berm two bags high and a silt fence were installed along the perimeter of MDR and MSA limits of work to prevent stormwater on the contaminated portion of the site from leaving the site, as well as to prevent stormwater run-on from areas outside of the site. At MDR, sandbags were placed along the entire perimeter fencing. At MSA, sandbags were placed along the fencing to the northern and northwest. In addition, stormwater measures were placed along an existing dike running parallel with the access road, which was used to berm the northwest side of MSA.

Excavation activities were only conducted in the immediate area when dry weather was forecasted. Sandbags were placed as needed in drainage control swales and at drainage control discharge points or areas with high probability of erosion. Additional sediment control, such as silt barriers or hay bales encased in silt fencing, was used as well.

The excavation of metal slag and trace metal slag debris was performed from the land and during low tides to minimize in-water impacts. BMPs were implemented to reduce turbidity resulting from excavation activities that could disturb or suspend sediment in the water column. BMPs included the use of anchored silt curtains, as well as excavation during low tide events.

3.7.2 Silt Curtains and Water Quality Monitoring

Silt curtains were used at MDR and MSA to contain sediment from the sites. The curtains were anchored at the bottom and at both ends to enclose the excavations. The curtains were approximately 50 to 100 and 100 to 150 feet from mean lower low water for MDR and MSA, respectively.

Prior to shoreline construction activities (excavation, backfilling, and restoration), water quality monitoring for dissolved oxygen, pH, and turbidity, as well as collecting a water sample for dissolved metals and gamma spectroscopy analysis, were performed daily for a 5-day period at the point of compliance (20 feet outside the silt curtain, centrally located within the area where the silt curtain was installed) at both MDR and MSA. These samples were used to establish the background values for MDR and MSA.

During shoreline construction activities (excavation, backfilling, restoration), water quality monitoring was performed for dissolved oxygen, pH, and turbidity, as well as collecting a daily water sample for dissolved metals and gamma spectroscopy analysis. Water quality monitoring and sample collection was performed 20 feet outside the silt curtain, adjacent to the area being excavated, backfilled, or restored. In addition, during shoreline construction activities, dissolved oxygen, pH, and turbidity monitoring was performed daily at a location inside the silt curtains adjacent to the construction activity.

Due the proximity of the excavations to the San Francisco Bay, the sample results were compared to background samples obtained prior to the excavation beginning, samples obtained outside the silt curtain, and the water quality criteria from the National Ambient Water Quality Criteria standards based on the acute saltwater criteria maximum concentration (EPA, 2004) to evaluate the effectiveness of in-place controls. A water sample for gamma spectroscopy analysis was collected daily at a point directly inside the silt curtain. Monitoring continued during all construction activities. All results were below action levels. Water quality data were presented to the regulatory agencies during the weekly TCRA update conference calls during the course of the excavations.

Additionally, all pads were constructed applying BMPs (including hay bales and sandbags) around the exterior edge to limit stormwater from running off the pad without being collected.

4.0 FIELD EXCAVATION ACTIVITIES

This section provides a details of the activities performed during the excavation, removal, and screening of soils and debris from MDR/MSA.

4.1 EXCAVATION OF CONTAMINATED SOIL

Excavation at MDR/MSA began in May 2005 once mobilization was complete. The excavation at MDR was completed in September 2006. The excavation of the original boundary at MSA was completed by September 2006. The excavation of the extended MSA excavation area was completed by May 2007.

The original MDR excavation boundary in the Work Plan (TtEC, 2005a) included an area of approximately 1.2 acres in size (Figure 3-1). The excavation boundary at MDR was not modified or extended during excavation activities. The original MSA excavation boundary in the Work Plan (TtEC, 2005a) included an area of approximately 0.9 acres in size. Based on actual field conditions and accessibility, the final MSA excavation covered an area of approximately 1.5 acres in size (Figure 3-2). A 50-ft by 50-ft grid system was surveyed in and established across the excavation areas. The grid system was marked in the field and was used to track the required radiological surface surveying within the excavation boundary, control and record excavation progress, and assist in cataloging the collection of post-excavation samples.

After the surface screen was complete, material within the boundaries of the MDR and MSA that was above groundwater was excavated in 30.5 cm (12-in) lifts. Each of these lifts was surveyed in situ prior to excavation to identify and allow removal of radioactive material. Below groundwater, the entire soil/metal debris column was removed to the bottom of the excavation without surveying individual lifts, since surveying below the water surface is not effective. Where possible, the excavated material was placed directly onto the screening pads by the excavators. When this was not possible, trucks dedicated to hauling potentially impacted material were used to transport material to the screening pads.

Trenching at MDR/MSA was performed beyond the excavation limits along the perimeters of the excavations to confirm the extent of metal slag and debris and ensure that the metal slag and debris did not extend beyond the current excavation limits. Trenches were dug every 25 linear feet of the excavation. At MDR, minimal metal debris was identified at the southeastern end. The debris was excavated as part of the original excavation footprint. At MSA additional metal debris was identified at the northern, southern, and southwestern ends of the excavation (Figure 3-2). Therefore, at each site, the footprint of the excavation was extended to remove this material (field change request [FCR]-Metal Reef/Metal Slag [MRMS]-027) (Figure 3-2). Figures 4-1 and 4-2 show the maximum depths of the excavations at each site.

Each site had its own material screening area (Figures 3-1 and 3-2). Each of these areas consisted of two temporary pads: a dewatering/screening pad and a large debris pad. In addition, two staging areas were used to store fire bricks and LLRW. Most excavated material was placed in the dewatering/screening pads; large debris was segregated and moved to a separate screening pad. Prior to screening the excavated material, firebricks were manually removed and stored in a separate staging area. (Firebricks were segregated because they contain naturally occurring radioactive materials and require special disposal.) The dewatering/screening pads were designed to manage approximately 50 cubic yards (cy) (four separate truckloads) of excavated material at one time with sufficient area for heavy equipment to maneuver safely. The large debris pads were sized to manage approximately 15 cy of material at a time plus sufficient space for heavy equipment to maneuver safely.

Material placed on the dewatering/screening pads was spread out in 6-inch lifts at MDR and in 30.5 cm (12-in) lifts at MSA. As necessary, the material was allowed to dewater prior to performing radiological surveys. The surveys were performed manually for beta/gamma emitters as detailed in Section 5.0 of the Work Plan (TtEC, 2005a). Radioactive material identified during screening activities was collected, segregated, and stored in appropriate containers for subsequent packaging and disposal under the direction of the DON LLRW Disposal Program.

A minimum of one solid sample was collected for each approximate 14 cy stockpile of material placed on the screening pad. The sample was collected at the location exhibiting the highest gamma radiation measurement. Additional samples were collected at locations where the investigation level was exceeded. The samples were analyzed in the on-site radiological laboratory by gamma spectroscopy prior to moving the soil. Radiologically contaminated material identified during surveys or sample analysis was placed in storage containers at the originating site pending appropriate disposal. Water from the dewatering/screening pads was collected, characterized for chemical and radiological constituents, and properly disposed. Wastewater sampling was conducted according to the procedures and frequency detailed in the *Final Sampling and Analysis Plan for Metal Debris Reef and Metal Slag Areas Parcels E and E-2* (SAP) in the Work Plan (TtEC, 2005a). Radioactive Material Management was performed in accordance with the requirements of New World Technology, Inc.'s (NWT's) NRC license.

Excavated material on the large debris pads was also screened manually for alpha and beta/gamma emitters. Radiologically contaminated material identified during debris screening was stored at the originating site pending proper disposal.

Excavated material not radiologically impacted, as well as large debris that passed field screening, were transported by truck to the appropriate pad at MDR where it was stockpiled. Stockpiled material was then further characterized to support off-site disposal as non-radiological waste by collecting additional samples for chemical analysis. These samples were analyzed at an off-site laboratory. When properly characterized, these wastes will be transported off site for proper disposal. Trucks transporting these non-radiological wastes passed through the on-site portal monitor prior to exiting HPS. All future shipments will pass through the on-site portal as well. To see the quantities of material that have been shipped and the quantity that remains on site, see Section 6.0.

Stockpiles were managed in accordance with the SWPPP in the Work Plan (TtEC, 2005a) and sampled for laboratory analysis in accordance with the SAP in the Work Plan (TtEC, 2005a), pending subsequent disposal. Large debris that was radiologically cleared was placed in roll-off bins for transportation to and disposal at a CERCLA Off-site Rule-approved landfill.

To minimize potential worker exposure to, and spread of, contamination during excavation, screening, and stockpiling, dust suppression measures were implemented. Air monitoring for radiological constituents was performed. Non-radiological constituents, such as PCBs, particulates and metals, were monitored as necessary for health and safety purposes in order to evaluate the effectiveness of these measures per the Site Health and Safety Plan (SHSP) in the Work Plan (TtEC, 2005a). Surface water monitoring during excavation activities was also conducted.

4.1.1 Buried Drums, Bottles, Jars, and Containers with Unknown Content

During the course of excavation activities, drums, bottles, jars, and containers were occasionally encountered at various locations within the sites. A written procedure for handling buried drums, jars, and containers with unknown content was developed and implemented (see FCR-MRMS-037 in Appendix J) outlining the requirements for safe excavation, removal, handling, and sampling of any such unearthed items. See Section 6.0 for a detailed account of drums, bottles, jars, etc. that were removed during excavation. Many of the bottles, jars, and containers encountered were not identified until the soil was spread out on the screening pads for scanning.

4.1.2 Materials Potentially Presenting an Explosive Hazard

During intrusive work activities at MDR/MSA, a TtEC Unexploded Ordnance (UXO) technician was on site in case a suspect item thought to be materials potentially presenting an explosive hazard (MPPEH) was encountered. All work executed by the TtEC UXO technician was performed in accordance with the Op-5, Volume 1 (NAVSEA, 2005).

Personnel assigned to work at MDR/MSA, including subcontractor personnel, were required to attend a training session on the identification of possible UXO items and the procedures to follow once a suspect item was identified. In addition, prior to the start of work activities each day, a daily UXO safety briefing was given at MDR/MSA in addition to the normal safety briefing.

MPPEH was defined as any component of ordnance or explosive munitions that may have come into contact with energetic material (i.e., high explosives or propellant) and could have energetic residue remaining. Examples of MPPEH scrap encountered during the project included expended cartridge casings of various calibers and 5-inch projectile protective caps. In total, there were 62 MPPEH items encountered at MDR/MSA as presented in Table 4-1. The items totaled approximately 1,500 pounds. Many of the MPPEH items encountered were not identified until the soil was spread out on the screening pads for scanning. All MPPEH items were radiologically released after surveys were performed by Radiological Control Technicians (RCTs) under the supervision of UXO technicians.

During the course of the project, MPPEH identified by the TtEC UXO technicians was labeled with a numerical identification number, photographed, and placed into a labeled, 55-gallon drum for temporary storage on HPS. The items encountered were labeled and stored using two categories: 1) 3X (possibly contains an explosive hazard) and 2) 5X (contains no hazards). The information was then entered into the Acquisition and Accountability Log for tracking. The Acquisition and Accountability Log is maintained in the project files. At the end of each work day, the drum was sealed. The drums used for storage of collected MPPEH were located at Building 704.

Upon completion of all work activities by TtEC in Parcel E and E-2, items encountered will be re-inspected by UXO technicians for possible explosive hazards. The items certified as being safe will be demilitarized (crushed, burnt, cut, etc.). The remaining items of unknown condition will be treated to neutralize the possible explosive hazard and then also demilitarized. Upon demilitarization, all items will then be certified as safe to ship and turned over for scrap. This action is still pending.

4.1.3 Well Destruction

During the course of the TCRA only one groundwater monitoring well (MW-300A) had to be destroyed. The well was located at MDR and was destroyed on March 14, 2006. The destruction of the well was completed in a manner consistent with the specifications outlined by the California Department of Water Resources (1991) and the Work Plan (TtEC, 2005a).

4.1.4 Fugitive Dust Control

Aggressive dust control measures were used during excavation at MDR/MSA. Continuous air monitoring was performed during intrusive excavation activities. Additionally, the wind speed was constantly monitored and if the wind speeds exceeded 25 miles per hour, then excavation and soil handling were discontinued. Appendix A contains weather data from the on-site weather station including wind speed and direction. Dust-control measures included dust suppression, covering of stockpiles with 10-mil liner, and ceasing activities when wind speeds were high.

A water truck or water tank equipped with a hose to mist the soil and debris during excavation, segregation, and screening activities was used for dust suppression activities.

Air monitoring during excavation, segregation and screening activities included total suspended solids, particulate matter (PM_{10}), PCBs, asbestos, and ROCs. Field operations were conducted to minimize airborne dust and meet the derived airborne concentrations in Table 4-2 as much as possible. The air monitoring data were combined with the weather data collected to insure the safety of the site workers and the public in the area surrounding HPS. A stand-alone report detailing air monitoring results will be submitted by the air monitoring subcontractor in the spring of 2007.

4.1.5 Instrumentation for Radiological Surveys

In support of the radiological control objectives for this TCRA, various instruments were used to detect the radioactive material known or suspected to be present within MDR/MSA. The instruments and measurement methods were selected for their ability to detect the ROC or radiation types of interest, and capability of measuring levels sufficient to support the data quality objectives (DQOs) when used with the appropriate survey or analytical technique. Table 4-3 identifies the instrumentation used for radiological surveys.

4.1.6 Radiological Surveys and Post-excavation Sampling Approach and Results

The radiological RAO of the excavation was to remove low-level radioactive material to eliminate pathways of exposure to hazardous substances for surrounding populations and ecosystems due to erosion from tidal influence. This could be further subdivided into two more definitive sub-RAOs of: 1) to identify and remove discrete radioactive materials (point sources), and 2) to identify and remove sources of radioactivity that cannot be readily identified as point sources. Once the excavation had been completed and identified sources of radioactivity were removed, the objectives shifted to collect post-excavation samples to fully characterize the bottom of the excavation for the Draft Revised RI Report for Parcel E and in the Draft RI and FS Report for Parcel E-2 and to backfill and restore the shoreline.

4.1.6.1 Surveying and Sampling During Excavation

After removal of each lift, the in-situ soil was surveyed with a high density gamma scan to identify and allow removal of any radioactive materials that may have been present. If radioactive material was noted, the area indicated was further excavated and re-scanned to confirm complete removal.

Excavated materials were placed on dewatering/screening pads; large-size debris was segregated and moved to a separate screening pad. During the initial surveys of excavated soils, extensive radiological contamination had been identified at the MDR area. To better identify the sources of contaminated material, excavated soil was placed on the dewatering/screening pads and spread out in 6-inch lifts at MDR. At MSA the excavated soils were placed on the dewatering/screening pads in 30.5 cm (12-in) lifts and allowed to dewater. Materials on the large debris pad were screened manually for alpha and beta/gamma emitters.

A minimum of one solid sample was collected for each truckload (approximately 14 cy) of excavated material on the dewatering/screening pads. The sample was collected at the location exhibiting the highest gamma radiation measurement. Additional samples were collected at locations where the investigation level was exceeded. The samples were analyzed at the on-site radiological laboratory by gamma spectroscopy prior to moving the surveyed soil.

Water from the dewatering/screening pads was collected, characterized for chemical and radiological constituents, and properly disposed of. Wastewater sampling was conducted according to the procedures and frequency detailed in the SAP in the Work Plan (TtEC, 2005a).

4.1.6.2 Scanning Measurement Techniques

Surface scan surveys for gamma radiation were performed by traversing a path at a speed (scan rate) not exceeding 0.5 meters per second (m/s) (1.6 feet per second), while maintaining the detector approximately 10 cm (4 inches) above the area being surveyed. Additional radiological surveys were performed on the screening pad materials to properly characterize the material for disposal.

All gamma scans were performed in accordance with the HPS Standard Operating Procedure (SOP) HPO-Tt-006 (TtFW, 2005b) Radiation and Contamination Surveys. The investigation level for gamma surveys was established as the reference area mean + 3σ, where σ is the standard deviation of the gamma readings in the reference area. The background reference area was established in a non-impacted area of Parcel E. All survey data were reviewed by the Radiation Safety Officer (RSO) to identify any trends or in cases where the investigation level was exceeded to determine required supplemental surveys.

Where practical, scan surveys for gamma radiation were performed using a towed array system consisting of four arrays of three Ludlum Model 44-10 scintillation detectors spaced 30.5 cm (or 12-in) apart connected to a Ludlum 4612, 12 detector single channel analyzer and a GPS receiver to correlate logged data points to specific coordinates. In cases where the towed array could not be used surveys were performed by hand by a RCT. Areas that contained Bay Mud, other obstacles or were below groundwater level were not surveyed. Scan data for the post-excavation grid sampling was not collected as the excavation floor was subject to tidal influence and often under water. Any radioactive material identified by scan surveys was removed, segregated, packaged separately, stored, transported off site and disposed of in compliance with the DON LLRW Waste Disposal Program.

4.1.6.3 Systematic Grids

Each excavation boundary footprint was also divided into a series of systematic grids, each not exceeding 2,000 square meter (m^2) (approximately 2,400 square yards [yd^2]) in area. Each systematic grid was given a numerical designation. A total of 7 systematic grids were used at MDR and 5 systematic grids were used at MSA. Systematic grids were not added for areas of expanded excavation resulting from findings of limited trench sampling. Figures 4-3 and 4-4 show the radiological sampling grids for MDR/MSA.

4.1.6.4 Post-Excavation Surveying and Sampling

Post-excavation surveying and sampling consisted of sample collection from grid locations within survey units. Sidewalls and limited trenches of each grid were first surveyed upon completion of excavation, and then re-surveyed prior to sampling. Once a grid was considered free of radiological sources using field instrumentation, the grid was then ready for both chemical and radiological sampling.

Two different types of post-excavation samples were collected – random and systematic.

Randomly located post-excavation samples for radiological analysis were collected at a rate of one per randomly located point within each 50-foot by 50-foot grid cell of the excavation bottom, and one random sample from every 50 linear feet of perimeter sidewall.

Systematically located post-excavation samples were collected at a rate of sixteen per survey unit, and most had more than sixteen samples collected. The MSA excavation boundary was divided into five 2,000 m^2 (approximately 2,400 yd^2) cells while MDR was divided into seven 2,000 m^2 (approximately 2,400 yd^2) cells. Further, a 100 percent high density gamma scan was performed at the vertical excavation limit to further identify if any additional discrete gamma emitting sources were present. These scans were completed in areas that were not fully saturated with water.

One additional sample was collected from each trench bottom from the trenching performed at MDR and MSA. For chemical sampling, a computer-generated random point had to fall within a 30 by 30 meter (100 by 100-foot) grid. If it did not, no sample was taken.

While not required per the work plan, in a couple of instances, agreements were made to perform over-excavation at MSA. Over-excavated areas were not placed into survey units. However, the remaining suite of post-remediation sampling for sidewall, random grid and limited trench sampling was performed to determine the extent of contamination.

Random and systematic samples were analyzed for gamma-emitting radionuclides by the on-site radiological laboratory. Trench samples were analyzed by the on-site laboratory for radiological contaminants only if the radiological survey of the soil and debris indicate radioactive materials greater than 3 sigma of the background.

Ten percent of the samples were randomly selected to be sent to an off-site radiological laboratory for gamma spectroscopy analysis for QA purposes. Data from the on-site and off-site gamma spectroscopy analysis was compared for samples that had count times and MDAs that are within 20 percent of one another. ^{90}Sr analysis and alpha spectroscopy was performed by the off-site laboratory on samples if elevated levels of ^{137}Cs were identified during on-site laboratory gamma spectroscopy analysis. Tables 4-4 through 4-7 present the on-site and off-site post-excavation radiological data for comparison. On-site systematic sample results can be found in Appendix M, while the off-site sample data can be found in Appendix N.

4.1.7 Radiological Post-Excavation Survey Results

Results of onsite and offsite sample analysis for post-excavation samples are presented in Tables 4-4 through 4-7. Areas where RROs were exceeded were highlighted in red.

There were a few samples collected from random, systematic, random-sidewall, and limited trench locations at the bottom of the MDR and MSA excavations that showed activity near or above the RROs. See section 9.4.1 for a discussion of specific samples exceeding the RROs. In a manner consistent with chemical analyses, when an elevated area was identified for a given sample, the results of complementary sample analysis (i.e., offsite analysis), if available, were scrutinized. In the absence of complementary analysis, the results of other samples taken from the same base grid were compared. When this approach was employed there were no cases where multiple samples for a given grid showed elevated readings. Knowing that surface scans were also performed, it is reasonable to assume that an isolated point source would have been identified and removed during the surface scan. It was, therefore, concluded that the few elevated readings observed in the data tables are simply isolated areas and not indicative of widespread contamination.

4.1.8 Chemical Post-Excavation Survey Results

Chemical post-excavation samples indicated residual PCBs, specifically Aroclor 1260, and metals contamination at both MDR and MSA. Aroclor 1260 and copper concentrations are presented in Appendix D and are presented on Figures 4-5 and 4-6. In addition, residual concentrations of metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, vanadium and zinc), PCBs (Aroclor 1260), and pesticides (4,4'-DDT, 4,4'-DDD, 4,4'-DDE and dieldrin) were detected at levels exceeding the effects-range median (ER-M). These results are available for use in the Draft Revised RI Report for Parcel E and in the Draft RI and FS Report for Parcel E-2.

5.0 BACKFILL, COMPACTION, AND GRADING

Once post-excavation sampling of MDR/MSA had been completed, a layer of geotextile material was placed within each excavation and backfilling was performed. The geotextile material was placed over the entire bottom and sidewalls of the excavation. The purpose of the geotextile was to serve as a demarcation of the final excavation boundary.

Following placement of the geotextile material the excavation was backfilled with clean import fill material. Import material was sampled prior to use in accordance with the SAP in the Work Plan (TtEC, 2005a). Once the potential backfill source material was sampled, analytical results were reviewed as specified in the Work Plan (TtEC, 2005a). The Work Plan included requirements for chemical and radiological results analysis and acceptance, as appropriate, for the specific material. Prior to backfill operations, a potential source of free material was identified at the Letterman Area at the Presidio. The site was sampled as described above, and eventually certified as usable material. Upon later review of the analytical results, it was discovered that there were detections of TPH and chlordane. There were no established criteria for TPH in backfill, although there were applicable criteria for chlordane. Once identified, the affected material was removed from the excavation and properly disposed. All subsequent backfill material met the applicable criteria. The backfill soil sampling data for the backfill sources are presented in Appendix E.

The following amounts were used to backfill MDR/MSA:

Angel Island Sand – 24,000 tons
Armor/Rat Rock – 3,628 tons

Backfill material was placed in the excavation in 30.5 cm (12-in) lifts. Where possible, the backfill material was compacted by wheel or track rolling to a firm, unyielding condition and verified by the TtEC Field Engineer. No compaction testing was required since the site is slated for open space reuse. The final 6 inches of backfill was not compacted, but was graded to match its surrounding elevation for appropriate drainage and eventual site restoration.

5.1 TOPOGRAPHIC SURVEY

To allow comparison with the pre-excavation topographic survey (Figures 5-1 and 5-2), MDR/MSA were resurveyed following backfill and final grading (Figures 5-3, and 5-4). The figures document the pre- and post-excavation surface elevations. The surveys recorded the topographic conditions of the land area within the final MDR/MSA excavation boundary in sufficient detail to generate a topographic map with 1-foot elevation contour intervals.

The topographic survey included the establishment of transects spaced 25 to 50 feet apart, covering the entire MDR/MSA. Horizontal and vertical data were collected approximately every 10 feet and at major land breaks on these transects. The topographic survey was referenced to North American Datum 1927 (NAD 27), California State Plane Zone 0403, in U.S. survey feet. The vertical data was referenced to National Geodetic Vertical Datum of 1929 (NGVD 29). Topographic survey, layout, and related work were performed by a Professional Land Surveyor registered in the state of California. The surveyor's report is included in Appendix H.

5.2 DEMOBILIZATION

In November 2006, backfill, compaction, and final grading of MDR/MSA were completed and demobilization activities were initiated. Demobilization included the decontamination and free-release surveying of construction equipment and materials, cleaning of the MDR/MSA project site, performing final radiological surface surveying of disturbed areas, and issuing a certification of completion. Demobilization activities also involved final collection and disposal of decontamination water. At MDR, portions of the screening, staging, and stockpile pads were left in place for reuse during a planned follow-on removal action effort. At MSA the stock pile pads were removed.

Prior to removing equipment and materials from MDR/MSA, decontamination and radiological free-release surveying was completed. Before chemical decontamination of equipment, preliminary radiological surveys, consisting of a 100 percent scan of accessible areas for alpha/beta contamination were conducted. If radioactive contamination above the established criteria was identified during the initial scans (as defined in Table 2-3), the contamination was removed and chemical decontamination initiated. Chemical decontamination of heavy equipment and materials was completed at the site decontamination pad located near the main site entrance/exit. Heavy brushes were used to remove soil and dirt attached to the equipment surfaces. Special attention was paid to removal of soil and dirt on and within the bucket, the tracks/tires, and undercarriage of the equipment. If dry decontamination practices were not sufficient, the soil residue was removed using low-pressure washing with water.

Following chemical decontamination, radiological free-release surveys, consisting of surface scans and removable contamination swipe samples were performed by the radiological subcontractor prior to releasing any equipment to rental vendors. Hand tools used for radioactive material removal were surveyed for free-release. Radiological free-release surveys were documented by the radiological subcontractor and each piece of equipment received a unique survey number. All equipment used was eventually cleared of radioactive material and released back to the rental vendor.

Decontamination water was periodically pumped from the sump within the decontamination pad into an on-site wastewater collection tank and sampled. The collected decontamination water and other wastewater collected within the wastewater collection tank was sampled for radioactive constituents prior to being disposed of by using the on-site sanitary sewer under permit from the San Francisco Public Utilities Commission, Bureau of Environmental Regulation and Management. A separate permit was obtained for each disposal event.

Demobilization at MDR/MSA also included site-cleaning activities. Site cleaning consisted of repairing erosion or runoff-related damage; grading all areas used for construction; and removing all excess construction material, wood, debris, and other foreign material from the site. Repairs to erosion or runoff-related damage included replacing and reinforcing hay bale and sandbag berms surrounding the lined stockpile pad areas and site perimeter. Areas outside MDR/MSA that had been disturbed during the removal action, including equipment and debris staging areas, were graded to remove rutting and provide proper drainage. Leftover trash, wood, debris, and other foreign materials were collected and segregated by type for proper off-site disposal.

Following the removal of all trash and debris, the ground surface within the unexcavated areas at MDR/MSA, including padded laydown areas, was surveyed for gamma-emitting radionuclides. Radiological scan surveying was performed by walking the areas with Ludlum Model 2350-1s data logger equipped with Ludlum Model 44-10 2-inch by 2-inch NaI detectors. Data obtained from the pre-mobilization initial land surface scan survey were compared to the data collected during the demobilization scan survey to ensure that radioactive materials were not relocated or additional radioactive contamination had not been introduced to MDR/MSA.

Demobilization of MDR also included preparing the lined screening pad area for planned reuse during follow-on TCRA activities. The pad area was covered with a layer of 20-mil polyvinyl chloride (PVC) liner to eliminate potential erosion of the support structure. Prior to the covering the pad areas with PVC liner, materials were glued together at the seams to create a protective layer impenetrable to precipitation. The PVC protective liners were designed to preserve the pad areas during inclement winter weather for reuse.

5.3 SITE RESTORATION

Upon completion of backfilling and final grading of all disturbed areas, MSA was revegetated using hydroseeding. Revegetation was performed to prevent long-term surface erosion and increased sedimentation to the Bay following disturbance. Hydroseeding of MDR/MSA occurred on November 8, 2006.

Hydroseeding was performed by applying a mixture of seed, organic material, fertilizer, binder, and straw over the surface of the site through a multi-step application process. First, an approved seed mixture, fertilizer, wood fiber material, and a binder component were applied to the disturbed areas of the site. Applying the mixture was accomplished by spreading the materials with a high-pressure sprayer mounted on a vehicle equipped with a material holding tank. The seed, fertilizer, wood fiber, and binder were each loaded into the vehicle through a feeder hopper equipped with a mixing turbine. Once the materials were loaded into the vehicle in the proper proportions the vehicle was driven over site and an even coating of the mixture was sprayed over the land surface. Then a weed-free straw was spread over the site covering the first coating of hydroseed mixture. Straw was applied by towing a specialized machine in which bales of the straw were fed and sprayed at an even rate. Finally, a second coating of the hydroseed mixture was sprayed over the layer of straw. Application of the second coating was accomplished by following the steps described for the first hydroseed application.

The seed mix used for hydroseeding consisted of a mixture of native and sterile cereal grain seed types. Sterile seed was selected to more rapidly colonize the area and provide short-term soil stabilization with root growth. Native vegetation seed was selected to provide long-term soil stability starting the following year. This seed mix was successfully used previously at the Parcel E-2 Landfill.

5.4 FIELD CHANGES

To provide for a safer conduct of the field work, improve production, and meet the unexpected changes in site conditions the FCR process was used to address unforeseen circumstances during the implementation of the TCRA. The FCR process is utilized when changes are requested by construction or other qualified personnel at the site. An FCR is used to document a change to the "as designed condition" and request or suggest a solution. The FCR process requires that any requested changes to project design specifications or plans be reviewed and approved by multiple technical specialists prior to implementation. During work at MDR/MSA, a total of 33 FCRs were completed that affected these sites. All FCRs relating to radiological materials were pre-approved by the RASO before implementation. The HPS FCR Log and copies of the FCRs that affected work at MDR/MSA are provided in Appendix J.

5.5 COMPLETION INSPECTIONS

The Pre-Final Completion inspection was performed as summarized below. Appendix B contains documentation from the Pre-Final Completion inspection performed at MDR/MSA. The Final Completion Inspection has not been performed to date.

5.5.1 Pre-Final Inspection

The purpose of the pre-final inspection is to identify punch list items that need to be completed prior to job end. An initial pre-final inspection has been performed; however the HPS ROICCs have requested CTO wide pre-final and final inspections, rather than site specific inspections. The CTO wide pre-final inspection has not been completed as of the writing of this document.

5.5.2 Final Acceptance Inspection

The purpose of the final acceptance inspection is to verify that all specific items previously identified as incomplete or unacceptable during the pre-final inspection are completed and acceptable. As of the writing of this document, the Final Completion Inspection has not been completed.

5.6 PHOTOGRAPHIC LOG

Photographs of the site were obtained during the implementation of the TCRA activities. Photographs were taken during each aspect of work in order to provide the DON with a detailed photographic history of the TCRA at MDR/MSA. Electronic versions of the photographs sorted by date and accompanied by a Project Photographic Log were developed and kept in the MDR/MSA electronic project file. A photographic log and a selection of photographs from all phases of the TCRA are presented in Appendix I.

6.0 WASTE CHARACTERIZATION, DISPOSAL, AND RECYCLING

This section describes the disposal method for each waste stream generated during the removal action. There were several waste streams that resulted from the removal activities. These waste streams included contaminated soils, drums, bottles, jars, and small containers, decontamination wastewater, used personal protective equipment (PPE), and metal debris. Over-packs and lab-packs were handled and disposed of by TtEC. A summary of the wastes generated is presented in Table 6-1.

Trucks hauling waste off site were inspected prior to loading. Additionally, all vendors were pre-qualified and the driver's license and medical card were checked to ensure they were current. A uniform hazardous waste or a non-hazardous waste manifest was filled out for each loaded truck and submitted to the DON for signature. Prior to shipment, original copies of the manifest were provided to the transporter for shipment. Copies of the waste profiles and waste manifests are included in Appendix F.

6.1 SOILS AND DEBRIS

Approximately 18,010 cy of contaminated soil and debris requiring off-site transportation and disposal were generated during the removal action at MDR/MSA. Stockpiled soil that did not contain radioactive material was sampled to characterize the soil for proper disposal. The samples were sent to an off-site laboratory and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), including polynuclear aromatic hydrocarbons (PAHs), pesticides, PCBs, total purgeable petroleum hydrocarbons (TPH-purgeable), total extractable petroleum hydrocarbons (TPH-extractable), and Title 22 metals. No additional radiological analyses were necessary, as this soil was evaluated for radiological contamination prior to being stockpiled. Approximately 1,050 cy of large debris, including concrete, small pieces of asphalt, wood, lumber, metal objects, rubber tires, drums, bottles and other similar waste materials were recovered during the excavation activities. The materials that exceeded the screening criteria in Table 2-3 were handled as LLRW. Prior to stockpiling, the materials were hand scanned for radioactivity.

Approximately 1,700 tons of soil and materials were placed in roll-off bins and disposed of as LLRW. Further, 77 devices and 63 buttons (discrete gamma-emitting devices [point sources]) and 23 pieces of radioactively contaminated debris were removed during soil screening. These point sources were transferred to the Army contractor in compliance with the DON LLRW Disposal Program and properly stored in Building 406 pending isotopic identification and subsequent disposal. All radiological debris and mixed waste was disposed of at either US Ecology, Grand View, Idaho; or Energy Solutions, Grantsville, Utah

Approximately 12,000 cubic yards of soil was determined to be non-RCRA hazardous solid waste based on waste characterization sampling and was handled under profile number EH0154 and ECDC12616. The soil and debris were transported off site and disposed of at the Chemical Waste Management, Inc., Kettleman Hills Facility located in Kettleman City, California, and at the ECDC Environmental Facility located in East Carbon, Utah.

Transportation of the waste off site began October 20, 2005. The soil and debris were transported using dump trucks, which were covered prior to leaving HPS. A waste manifest was completed for each truckload transported off site and submitted to the DON for signature. Original copies of the manifests were provided to the transporters and the disposal facilities. Copies of the generator's waste profile and manifests are provided in Appendix F.

6.2 DRUMS, BOTTLES, JARS, AND CONTAINERS WITH UNKNOWN CONTENT

At MDR/MSA, 36 drums with content and 7 small containers were recovered from the excavation. Many other drums were found during the excavation, however they did not contain any content and after screening they were treated as scrap metal. Drums were in various conditions upon discovery, ranging from crushed and deteriorated to rusted but structurally sound and holding contents. The drums which contained diesel-contaminated soil, grease, PPE, plastic, metal pieces, and wood and were discovered in varying degrees of decay. Because of the condition of the recovered drums, contents from the drums were placed into over-pack drums for proper handling and disposal. Some of the small containers and bottles contained liquids.

Drums and small containers unearthed during the excavation activities were first screened by field instruments for radioactivity and then sampled and analyzed for the presence of radioactive materials. Additional analyses such as ^{90}Sr and gamma spectroscopy were requested for several drums based upon review of the sample results.

For waste characterization, the over-pack drums and small containers underwent on-site HazCat analysis for "waste compatibility screening," which is defined as a series of rapid, qualitative and physical tests to determine potential hazards, handling precautions, storage criteria, and disposal classification of the materials in question. The over-pack drums consisted of non-hazardous, Resource Conservation and Recovery Act (RCRA) waste based on HazCat and radiological analyses. The over-pack drums were transported off site and disposed of at the Chemical Waste Management, Inc., Kettleman Hills Facility for subsequent transfer and disposal by incineration at Onyx Environmental Services, Port Arthur Treatment Facility in Port Arthur, Texas.

One over-pack drum was determined to be mixed waste based on HazCat and radiological analyses. Drum D-366 consisted of dark grey soil with rubber pieces (belts and gaskets) and exhibited elevated levels of Radium-226 (^{226}Ra). The impacted drum was transferred to the Army contractor in compliance with the DON LLRW Disposal Program and properly stored in Building 406.

Tables F-1 and F-2, "MDR/MSA Container Log" and "MDR/MSA Drum Log, contain all the relevant information of each over-pack and lab-pack drum, including drum number, accumulation start date, disposal date, storage location, contents, waste designation, sample information, disposal facility, profile number, proper shipping names, EPA/Department of Toxic Substances (DTSC) codes, label information, and manifest type and number. Profiles and manifests are provided in Appendix F.

6.3 WASTEWATER STORAGE AND DISPOSAL

Wastewater generated from equipment decontamination activities was collected and stored in 6,500-gallon Baker tanks. A total of 12,000 gallons of wastewater was generated during the removal action. For waste characterization, one water sample per tank was collected and analyzed for VOCs, SVOCs, including PAHs, pesticides, PCBs, Title 22 metals, TPH-purgeable, and TPH-extractable, Hexavalent Chromium, herbicides, pH, oil/grease, cyanide, sulfides, flash point, phenols, chemical oxygen demand, total suspended solids, and total dissolved solids. Radiological analysis using on-site gamma spectroscopy was also performed on the samples. None of the water samples indicated radioisotope activity greater than the water release criteria stated in the Revised AM (TtEC, 2006). All wastewater was disposed of by using the on-site sanitary sewer under permit from the San Francisco Public Utilities Commission, Bureau of Environmental Regulation and Management. A separate permit was obtained for each disposal event.

6.4 USED PPE

All on-site activities were performed in modified Level D PPE. Chemically contaminated used PPE was consolidated with similar non-hazardous wastes in over-pack drums and transported off site and disposed of at the Chemical Waste Management, Inc., Kettleman Hills Facility for subsequent transfer and disposal by incineration at Onyx Environmental Services, Port Arthur Treatment Facility in Port Arthur, Texas. Profile and manifest documentation are provided in Appendix F.

6.5 MISCELLANEOUS TRASH AND SOLID WASTE

Approximately 28 compressed gas cylinders were recovered during excavation activities. The cylinders were determined to be inert and disposed of as trash.

6.6 METAL DEBRIS

A total of approximately 61 tons of metal debris was recovered from the excavations, with relatively equal amounts generated from each site (MDR and MSA). The metal debris could not be adequately screened for radiological release due to the physical nature (shape, structure, and condition), and therefore was disposed of as radiologically impacted material. This metal debris was transferred into roll-off bins or properly secured onsite, pending disposal as radiologically impacted waste to be handled under the Army's LLRW program.

7.0 RADIOLOGICAL DATA ASSESSMENT AND CONCLUSIONS

Before analysis of data can occur, it is necessary to perform a data quality assessment of the associated radiological data. The first step in this process is to review the original DQOs before moving on to the data quality assessment phase, as described in the SAP to the Work Plan (TtEC, 2005a). This section will expand further the entire process that took place for MDR/MSA radiological data.

After the radiological data assessment has taken place, then it is appropriate to examine the data to determine if it supports completion of the RROs.

7.1 RADIOLOGICAL DATA QUALITY OBJECTIVES

DQOs are qualitative and quantitative statements that are developed to define the purpose of the data collection effort, clarify what the data should represent to satisfy this purpose, and specify the performance requirements for the quality of information to be obtained from the data. These outputs are used to develop a data collection design that meets all performance criteria and other design requirements and constraints. The EPA has developed a seven-step process to develop DQOs. During this process, it is important to note that the intent of the investigation is to define the extent of contamination and/or provide for a comprehensive risk assessment.

The Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) recommends using the seven-step DQO process in the design of radiological surveys. This process tailors the survey to the particular conditions around each survey situation. This section summarizes the DQO elements applicable to the surveys that were performed under this plan.

7.1.1 State the Problem

The DON had determined upon review of previous site history and investigations that the site contained metal slag and debris with radioactive anomalies thus requiring a TCRA.

7.1.2 Identify the Decisions

Are radioactive materials identified during the initial radiological survey? Are radioactive materials identified during the radiological survey of each subsurface soil lift? Are the ROC results for the grid post-excavation sampling below the RROs listed in Table 2-3. Does the radiological survey of the excavation indicate areas with greater than 3 sigma over background? Are radioactive materials detected during the ex-situ screening of the excavated material within soil to be excavated?

During the course of data assessment it was determined that errors were made in labeling samples at both MDR and MSA. To address this problem, a sample labeling matrix was designed and implemented in the early stages of the removal action. A database of original and corrected sample ID names was also created. All potentially affected samples were further scrutinized and where necessary the database was updated. For purposes of the analyses included in this document a mixture of corrected and original sample IDs were used depending upon when the correction was made. In some cases the samples had been analyzed and sample result reports generated with the incorrect sample ID,. In these cases, the original sample IDs were retained and are included in this document. In all other cases, samples IDs were modified and tracked appropriately. Further, in order to ensure an accurate presentation in this document, an extensive review and verification of secondary identifiers (such as sample date, time, and weight) was conducted as part of the data review and analysis.

After excavation was complete, post-excavation sampling was performed using two different grid systems, and a radiological survey was performed. Excavated soils were dewatered and scanned on screening pads for ex-situ screening to identify radioactively contaminated materials that may not have been detected during the surface survey and to ensure that no beta-emitting sources were present.

7.1.3 Identify Inputs to the Decision

Previous chemical and radiological investigation results from the soil samples collected within the MDR and MSA boundaries are as follows;

- Results from the initial radiological survey, pre-excavation soil samples, radiological survey of each 30.5 cm (12-in) lift of soil
- Post-excavation sampling and the post-excavation radiological survey
- Ex-situ screening of excavated material

7.1.4 Define Study Boundaries

For a land area, the study boundaries were the physical boundaries of MDR and MSA. For remedial action support surveys, the study boundary was the extent of the remedial action work area and associated support areas. Section 3.3 discussed the details of performing the pre-excavation radiological survey. Figures 4-1 and 4-2 of this completion report show the final excavation boundaries for MDR/MSA. The Work Plan (TtEC, 2005a) discussed the details of performing the radiological survey of each 30.5 cm (12-in) soil lift.

Post-excavation samples for PCBs, pesticides, Title 22 metals, and ROCs were collected within the bottom of the excavation and the sidewall slopes. Systematically located post-excavation radiological samples were collected at a minimum rate of 16 per systematic grid. One additional sample was collected from the trench bottom of each limited trenching location performed at

MDR and MSA. The complete excavation footprint was radiologically surveyed as described in Section 3.3.

7.1.5 Develop a Decision Rule

The decision rule was, "If the survey results demonstrate compliance with the release criteria, then document the results in the project completion report. If the survey results do not demonstrate compliance with the release criteria, then additional assessment and/or remediation are necessary."

The following were the decision rules used to evaluate the work that was performed:

1. If radioactive materials were identified during the field survey, the sources were removed.
2. If radioactive materials were identified during the survey of each 30.5 cm (12-in) lift, the sources were removed and the excavation of the lift proceeded. If radioactive materials were not identified, then excavation of the surveyed lift commenced.
3. If the radiological results for the grid post-excavation soil samples were above the RROs listed in Table 2-3, and/or radiological surveys in the grid detect areas with radiation greater than 3 sigma over background, then the information was documented and the grid was backfilled.
4. If radioactive materials were detected during ex-situ screening of the excavated material, it was handled as specified in the Work Plan (TtEC, 2005a) and the material from that grid was placed into an appropriate waste container for disposal. If no radioactive materials were detected during secondary screening, the soil was stockpiled for subsequent characterization and disposal.

7.1.6 Set Limits on Decision Errors

The pre-excavation characterization sampling plan was designed to generate sufficient data to better define the lateral extent of the metal slag and debris.

The initial and subsequent radiological surveys were performed in accordance with the Work Plan (TtEC, 2005a) and survey protocols were carefully followed to limit errors.

To limit decision errors, analytical method requirements and project-specific DQOs were established. Published analytical method and laboratory-specific performance requirements were the primary determiners of DQOs for precision and accuracy.

Third-party data validation was performed on all non-radiological samples, except for waste characterization samples. Eighty percent of the data was validated at EPA Level III and the remaining 20 percent was validated at Level IV. Sampling and analysis protocols were carefully followed to limit errors.

7.1.7 Optimize Data Collection

The details of the initial radiological survey were discussed in Section 3.3 of the Work Plan (TtEC, 2005a). In addition, soil that exceeded greater than 3 sigma above the mean background was treated as a potentially radiological waste and was analyzed by the on-site laboratory for confirmation.

The details of the radiological survey of each 30.5 cm (12-in) lift were discussed in Section 4.1.6. One random radiological post-excavation soil sample was collected on a 15m by 15 m (50ft by 50-ft) grid system along the bottom and one for every 15 m (50 ft) linear of sidewall slope of the excavation. Systematic post-excavation soil/sediment samples were also collected after establishing a grid consisting of 2,000 m^2 cells (2,400 yd^2) over the MDR/MSA excavation sites. Sixteen systematically located samples were collected from each grid cell (Figure 4-3 and 4-4). Random post-excavation soil samples were analyzed for PCBs, pesticides, Title 22 metals, and ROCs. Systematic post-excavation soil samples were also analyzed for ROCs.

The entire exposed soil area was gamma scanned to assess potential radiological contamination.

During work activities one solid sample was collected for every 14 cy of excavated material on the dewatering/screening pads. Additional samples were collected from areas of excavated material exceeding investigation levels. Water from the dewatering/screening pads was also collected and characterized for chemical and radiological constituents.

7.2 RADIOLOGICAL DATA QUALITY ASSESSMENT

This section details the field data assessment and the on-site laboratory assessment including data verification, data validation, data evaluation, and data quality assessment.

7.2.1 Field Data Assessment

The first level check for validating data integrity during collection and reporting was verification of numerical work. After collection of survey data each day, the results were reviewed by the RCT to verify their completeness. The purpose of the first level check was to ascertain that the data presented were free of numerical or transcription errors and that established procedures and methodology had been properly followed.

The RSO reviewed the data from the subcontractor to determine it met the appropriate criteria, including review of field logbooks, sample identifications, chains of custody, etc. No further action was required because all data were considered acceptable.

7.2.2 On-site Laboratory Data Assessment

Laboratory data were assessed to determine whether the objectives of the survey process were being met. The assessment process consists of four data phases: verification, validation, evaluation, and comparison. The assessment of HPS laboratory data ensures that the objective of the survey was met.

The laboratory sample data were tabulated and submitted in a format acceptable to the DON and regulatory agencies. The RSO reviewed the data from the contractor on-site laboratory to determine that data met SAP criteria (TtEC, 2005a). No further action was required because all data were acceptable.

7.2.2.1 Data Verification

Data verification ensured that the requirements are implemented as prescribed. Data verification activities included inspections of the laboratory, documented QC checks performed on laboratory equipment in accordance with the appropriate SOP, technical reviews of data, and audits as appropriate.

7.2.2.2 Data Validation

As stated in the SAP in the Work Plan (TtEC, 2005a), there were no standards for data validation of radiological analyses. Therefore, guidance documents and modified functional guidelines are used in validation of radiological data. Data not meeting method and/or SAP specifications were flagged as estimated or rejected.

7.2.2.3 Data Evaluation

On-site laboratory data are evaluated prior to submittal to the RASO. The evaluation of data was based on method requirements, results of QC checks, contamination in method blanks, and method spikes (as appropriate), and the overall indication of interference due to contamination. The data qualifiers, if used, were listed at the bottom of the data report. If the data was determined acceptable for use, no qualifiers appear.

7.2.2.4 Data Quality Assessment

Data Quality Assessment (DQA) is a scientific and statistical evaluation that indicates if the data were of the right type, quality, and quantity to support their intended use. DQA provided the assessment needed to decide if the planning objectives were met. All data presented as a matter of function in this report were subject to the DQA process, and the data was determined suitable for use.

8.0 EFFECTIVENESS OF THE REMOVAL ACTION

The RAOs included implementation and removal of contamination at HPS. The AM (DON, 2001a) for HPS documented the decision to undertake a TCRA at areas with radiological contamination in soils, debris/slag, and buildings. The RAOs were to implement the AM (DON, 2001a) as follows:

- Remove low-level radioactive material to eliminate pathways of exposure to hazardous substances for surrounding populations and ecosystems due to erosion from tidal influence.
- Address non-radiological chemical contamination incidental to the radiological removal.
- Collect post-excavation samples, and to backfill and restore the shoreline.

The RAOs were planned to be achieved by excavation and removal of metal slag and debris, and other materials above the RROs within the excavation boundary.

Limited trenching was done outside the excavation boundary and if any additional metal slag or debris was identified, it was removed as well.

The originally estimated volume of soil, metal slag, and debris to be removed at MDR was approximately 8,500 cy, but the final amount excavated was 11,200 cy. The original estimated volume of soil and metal slag at MSA was approximately 5,500 cy. Based on the trenching, the MSA excavation boundary was extended to the east and west increasing the total volume removed to 8,200 cy.

The effectiveness of the TCRA was established by evaluating the post-excavation samples. For MDR all samples (21 sidewall, 29 grid, and 22 trenching) were below the RROs (see Table 2-3). For the systematic grid samples, 121 of 123 usable samples obtained were below the RROs (see Table 2-3). At MSA, 39 of 41 sidewall samples, 25 of 26 grid samples, 28 of 32 trench samples, and 82 of 86 systematic grid samples were below the RROs (see Table 2-3). As discussed in Section 9.4 however, none of the elevated samples gives reasonable cause to presume that widespread contamination is present at MDR/MSA. In addition, 163 point sources and pieces of radioactively contaminated debris were removed during the excavations at MDR/MSA.

The RAOs stated above were achieved for both sites. Any remaining radiological materials are now under a cap of clean soil, thereby eliminating pathways of exposure to hazardous substances for surrounding populations and ecosystems. Non-radiological chemical contamination encountered during the radiological removal was removed. Post-excavation samples were collected to be used in the Parcel E and E-2 FS. The site was backfilled and the shoreline was restored.

9.0 QUALITY CONTROL AND QUALITY ASSURANCE

This section discusses QA/QC objectives for the MDR/MSA post-excavation, backfill material, and water quality monitoring samples. Chemical analysis was performed by Curtis and Tompkins, Ltd. (C&T), and off-site radiological analysis was performed by Eberline Services (Eberline). C&T and Eberline are state of California-certified and DON-evaluated laboratories. Subsequently, a third-party validation company (Laboratory Data Consultants, Inc.) performed data validation on the C&T analyses. The validation was conducted in accordance with *Environmental Work Instruction (EWI) #1, 3EN2.1, Chemical Data Validation* (DON, 2001b), the Contract Laboratory Program *National Functional Guidelines For Organic Data Review, EPA 54D/R-99/008* (EPA, 1999), the Contract Laboratory Program *National Functional Guidelines for Inorganic Data Review, EPA 54D/R-04/004* (EPA, 2004), the *Quality Systems Manual for Environmental Laboratories* (Department of Defense [DoD], et al., 2000), and the criteria specified in the Work Plan (TtEC, 2005a). Twenty percent of the samples were validated in accordance with an EPA Level IV-equivalent protocol. The remaining 80 percent of the samples were validated with an EPA Level III-equivalent protocol.

The chain-of-custody records and data validation reports (which include laboratory analytical results) are included in Appendix L. The analytical results from the sampling activities are presented in Appendices D, E, and G for the post-excavation, backfill material, and water quality monitoring samples, respectively.

The following sections describe the fulfillment of the field QC sampling objectives and analytical QC objectives for this project. Tables 9-1 through 9-3 summarize the samples and the associated analytical quality control objective for each method that were qualified by the validator as a result of the QC criteria outside of control limits.

9.1 FIELD QUALITY CONTROL SAMPLING OBJECTIVES

Field QC sampling objectives were met per the SAP contained in the Work Plan (TtEC, 2005a) including the collection of 48 field duplicates and 97 matrix spike and matrix spike duplicates (MS/MSDs). The results of the field QC sampling are described in the following sections.

9.1.1 Field Duplicates

Field duplicates consist of two samples (an original and a duplicate) of the same matrix collected at the same time and location, to the extent possible, using the same sampling technique. The purpose of the field duplicate is to evaluate the precision of the overall sample collection and analysis process through the calculation of the relative percent difference (RPD) for duplicate pairs. Field duplicates are routinely collected at a frequency of 1 per every 10 samples and analyzed for the same parameters as the original sample. The RPD QC limit was established at

25 percent, and 37 out of the 48 field duplicate pairs did not meet this criterion due to various project-specific factors, including non-homogenous matrix, high percent sample moisture, and sample analysis dilutions. Data are not independently qualified based on field duplicates RPD values; therefore, no results were qualified as a result of field duplicate RPDs outside of QC limits.

9.1.2 Matrix Spike and Matrix Spike Duplicate

MS/MSD samples are prepared for chemical analysis by spiking the sample with a known amount of a target analyte. Once the spike is added to the MS/MSD sample, the sample is carried through the complete sample preparation process along with the other samples in the batch. The percent recoveries (%R) for the MS/MSD samples are compared against each other and against the known amount of the spike to measure the accuracy of the analytical method. RPD values from the MS/MSD samples are calculated to evaluate the analytical precision of the method. One MS/MSD sample is routinely collected for every 20 samples. The %R and RPDs were within the specified QC limits described in the SAP contained in the Work Plan (TtEC, 2005a), except for those listed in Tables 9-1, 9-2, and 9-3. These samples were flagged "J/UJ" (estimated value or estimated at less than the laboratory reporting limit) for the associated analyses. For radiological analyses, a laboratory duplicate is prepared instead of an MS/MSD. The duplicate error ratio was within QC limits for all samples.

9.2 ANALYTICAL DATA QUALITY OBJECTIVES

The following sections describe the fulfillment of the analytical data quality objectives in terms of precision, accuracy, representativeness, completeness, and comparability parameters, as described in the SAP contained in the Work Plan (TtEC, 2005a).

9.2.1 Precision and Accuracy

In accordance with the analytical methods, the *Quality Systems Manual for Environmental Laboratories* (DoD, et al., 2000), and the SAP contained in the Work Plan (TtEC, 2005a) specifications, the following parameters were assessed by the third-party validation company as applicable to chemical analyses:

- Technical holding times
- Instrument performance checks
- Initial and continuing calibration verifications
- Method blanks
- Surrogate %R
- Laboratory control samples

- Minimum detectable activity
- Internal standards
- Inductively coupled plasma (ICP) Serial Dilution
- Target compound identification
- Compound quantitation
- System performance

9.2.1.1 Technical Holding Times and Preservation

Sample holding times and preservation were checked against QC criteria. Cooler temperature did not meet QC requirement for all samples as illustrated in Tables 9-1 and 9-2. Associated samples were flagged "J/UJ" for all compounds.

9.2.1.2 Instrument Performance Checks

Instrument performance checks were completed, and all QC requirements were met.

9.2.1.3 Initial and Continuing Calibration Verifications

Initial and continuing calibrations were performed. Percent relative standard deviations (RSDs) of initial calibration and percent differences (%D) of continuing calibration did not meet the QC requirement for all samples as illustrated in Tables 9-1, 9-2, and 9-3. Associated samples were flagged "J/UJ" for affected compounds.

9.2.1.4 Method Blanks

Sample concentrations were compared to concentrations detected in the method blanks. For sample concentrations either not detected or less than 5 times blank contaminant concentrations, associated results were flagged "U" (not detected). For sample concentrations detected but greater than 5 times blank contaminant concentrations, sample results were not affected. Table 9-3 lists the affected samples.

9.2.1.5 Surrogate Percent Recovery

Surrogate recovery applies to organic analyses. All surrogate percent recoveries were within QC limits, except for the samples listed in Table 9-1. These samples were flagged "J" for all detected compounds for associated analyses.

9.2.1.6 Laboratory Control Samples

All laboratory control samples were within QC limits, except for those listed in Table 9-2. Associated sample results were flagged "J/UJ".

9.2.1.7 Internal Standards

All internal standard areas and retention times were within QC limits except for samples listed in Table 9-3. Associated sample results were flagged "J/UJ".

9.2.1.8 ICP Serial Dilution

ICP serial dilutions (applicable to metals analysis only) were within QC limits except for the samples listed in Table 9-3 Associated samples and analytes were flagged "J".

9.2.1.9 Target Compound Identification

All target analytes were correctly identified.

9.2.1.10 Compound Quantitation

Compound quantitation (applicable to pesticide analysis only) were within QC limits except for the samples listed in Table 9-2. Associated samples and analytes were flagged "J".

9.2.1.11 System Performance

System performance met all QC requirements. No discrepancies were reported.

9.2.2 Representativeness

Representative data were obtained through selection of sampling locations and analytical parameters to meet the DQOs of this project. Proper collection and handling of samples, and the use of established field and laboratory procedures as described in the SAP contained in the Work Plan (TtEC, 2005a) were followed.

9.2.3 Completeness

The percent completeness is defined as the percentage of measurements judged to be valid. The completeness goal is to generate a sufficient amount of valid data to meet project objectives. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with an "R" flag for rejected. The requirement for completeness is 90 percent for soil samples and 95 percent for water samples. The percent completeness for soil and water samples is 100 percent for this project.

9.2.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurements for similar samples and sample conditions. The objective for the QA/QC program is to produce data with the greatest possible degree of comparability. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats.

9.3 OVERALL ASSESSMENT OF DATA

Overall, the data are valid and usable and has been qualified for analytical parameters that did not meet criteria as described in Section 9.2.

9.4 COMPARISON OF ON-SITE AND OFF-SITE RADIOLOGICAL DATA

This evaluation focused on both the effectiveness and the quality of the radiological sample analysis. For purposes of this evaluation, effectiveness is defined as the adequacy of the sample analysis method to detect ROCs at levels equal to or less than the applicable DCGL, while quality is defined as high degree of correlation between samples analyzed both on-site and off-site.

9.4.1 Effectiveness of Radiological Sampling

Tables 4-4 through 4-7 identify the activity, uncertainty and corresponding MDA for each sample analyzed by both on-site and off-site laboratories. Activity present above the RROs for any ROC is identified in red text. Post-excavation systematic sample results can be found in Appendix M. The ROCs for these analyses were ^{137}Cs and ^{226}Ra. MDAs for the on-site lab showed a strong trending value and the MDA for a particular ROC on any given sample was generally consistent across all samples. Off-site lab MDAs were in general comparable to on-site lab MDAs, but have less uncertainty and again showed good trending.

Levels of ^{137}Cs exceeded the RRO in onsite analysis of samples from MSA at the following grids:

- Grid 59 systematic grid (0.1189 pCi/g) and random grid (0.123 pCi/g)
- Grid 60 systematic grid (0.1131 pCi/g)

- Grid 61 systematic grid (0.169 pCi/g)
- Grid 64 sidewall (0.1153 pCi/g)
- Grid 68 sidewall (0.1378 pCi/g – onsite and 0.114 pCi/g - offsite)
- Grid 71 limited trench sample (0.159 pCi/g)
- Grid 74 limited trench, 2 samples (0.1329 pCi/g and 0.1886 pCi/g)
- Grid 92 systematic grid (0.1139 pCi/g)
- Grid 98 limited trench sample (0.1177 pCi/g)

and at the following grid in MDR:

- Grid 110 systematic grid (0.1181 pCi/g)

Grids with more than one exceedance include MSA grid 59 (2 samples above RRO), MSA Grid 68 (onsite and offsite analysis of same sample above RRO) and MSA Grid 74 (2 different samples from same grid).

In grid 59 at MSA, a total of 3 additional systematic grid, sidewall and limited trench samples show ^{137}Cs below the RRO. For MSA Grid 68, again 3 additional samples (systematic grid, random grid, and limited trench) show ^{137}Cs below the RRO. Finally in MSA Grid 74, six onsite and one offsite sample (systematic grid, random grid, and sidewall) confirm ^{137}Cs levels below the RRO. The additional data from these grids are sufficient to indicate that widespread contamination is not present in any of these grids. A similar analysis for the other elevated (near and above the RRO) ^{137}Cs samples in both MSA and MDR shows similar results with multiple confirmatory samples not detecting ^{137}Cs above the RROs. The elevated readings were thus deemed insignificant.

Measured ^{226}Ra levels for on-site analysis of the MDR Survey Unit 6, point B3, Grid 115 sample were above the RROs at 2.287 pCi/g. Measured ^{226}Ra levels for on-site analysis of the MSA Survey Unit 4, point C0, and Survey Unit 5, point C5, were above the RROs at 1.844 pCi/g and 1.970 pCi/g, respectively. No off-site sample was available for comparison. However, several neighboring samples from within the same grid were available for comparison and none of them showed elevated radium levels. Again this allowed for the conclusion that the elevated reading did not indicate widespread contamination of the entire grid.

As mentioned in Section 4.7.1, several other samples near the RRO were evaluated against neighboring samples from the same grid or against complementary laboratory sampling. In no case were there multiple confirmations of elevated readings in any grid sampled.

9.4.2 Quality of Radiological Sampling

The requirements in the Work Plan SAP (TtEC, 2005a) specified that 10 percent of all radiological samples would be sent off site for analysis and compared to on-site results. In achieving this goal, a comprehensive evaluation of the quality of all post-excavation radiological samples was performed. In comparing samples where both on-site and off-site analyses were performed, in all cases the results are similar to each other. The on-site and off-site sample data can be found in Tables 4-4 through 4-7.

9.4.3 Overall Assessment of Radiological Sampling Data

Analysis of the radiological sampling data has shown that the sample analysis had good quality and effectiveness. It is therefore concluded that the combination of on-site and off-site sampling clearly demonstrates that no widespread residual radioactive contaminants above the DCGLs were present at the sampled locations.

10.0 COMMUNITY RELATIONS ACTIVITY

Several community relations activities were conducted to inform the public of MDR/MSA TCRA activities. The remediation process was conducted in accordance with the *Final Radiological Risk Communication Plan* (Foster Wheeler Environmental, Inc [FWENC], 2003), the *Final Community Involvement Plan* (Innovative Technical Solutions, Inc [ITSI] and Tetra Tech, Inc., 2004b), and the *Final Community Outreach Plan* (TtFW, 2004). These documents were prepared for HPS to facilitate public involvement in the decision-making process and to keep the public informed of ongoing remedial activities.

10.1 PUBLIC INFORMATION

The Work Plan (TtEC, 2005a), this Removal Action Completion Report, and other documentation associated with remediation activities at HPS are contained in the Administrative Record for the site. The Administrative Record Index is maintained by NAVFAC SW and is available to the public at the NAVFAC SW offices at 1220 Pacific Highway, San Diego, California, 92132-5190.

The DON, as lead agency with state agency concurrence, has overall responsibility for public participation activities. As such, the Work Plan (TtEC, 2005a), this Removal Action Completion Report, and other documentation associated with remediation activities at HPS is available to the public at the Information Repositories. There are two public information repositories where the public can review any of the documents associated with the Administrative Record. The repositories are:

San Francisco Main Library
100 Larkin Street
Government Information Center, 5th Floor
San Francisco, CA 94102
(415) 557-4500

Anna E. Waden Library
5075 Third Street
San Francisco, CA 94124
(415) 715-4100

10.2 PUBLIC PARTICIPATION

To encourage local participation in the hazardous waste cleanup program at HPS, the DON established a Restoration Advisory Board (RAB). This board is a citizen-based committee representing local community interests. RAB meeting agendas, minutes, and presentation materials are included in the Administrative Record for public review.

The RAB held meetings during the investigation and field work. All meetings were advertised locally in an effort to encourage public attendance and participation. In addition, the DON prepared a master mailing list of the local community members, and whenever significant cleanup activities or decisions were planned, the community members were notified by mail for information purposes and involvement.

The original version of the AM (DON, 2001a) was issued to the RAB for review. A public notice was posted in the local newspaper, inviting public comments. The purpose of the public notice was to invite the interested community members to review the subject AM (DON, 2001a) and provide their comments or questions. During 2006, the AM (DON, 2001a) was revised as more stringent and additional release criteria were established (TtEC, 2006). Copies of the revised document were placed for review in the HPS Information Repositories. The most notable change in the AM revision was that the ^{137}Cs DCGL was revised downward approximately 13 percent, in keeping with the EPA PRG for this radioisotope. Once the AM revision was published as final, the more restrictive release criteria for ^{137}Cs was put into place for the remaining work performed under the TCRA.

To keep the public informed of ongoing activities at HPS the Navy periodically publishes fact sheets and distributes them to the public. During this project there were two fact sheets (Numbers 6 and 7) prepared that covered MDR/MSA. The facts sheets are included in Appendix K. Fact Sheet Number 6 was published in March 2004 and provided an update of work at MDR/MSA, including the issuance of the Draft Final HRA (NAVSEA, 2004). Fact Sheet Number 7 was issued in June 2005 and detailed the initiation of the TCRA at MDR/MSA, as well other activities in Parcels E and E-2. Fact Sheet Number 7 was mailed to 2,631 local community members on the HPS mailing list on June 15, 2005.

11.0 RECOMMENDATIONS

The RAOs for radiological materials, which were based on the AM (DON 2001a), were achieved for both sites. Any remaining radiological materials are now under a cap of clean soil, thereby eliminating pathways of exposure to hazardous substances for surrounding populations and ecosystems. Non-radiological chemical contamination encountered during the radiological removal was removed. Post-excavation chemical characterization samples were collected and are available to aid in refining the current understanding of chemical contamination at and adjacent to the MDR/MSA sites.

Recommendations for actions at or adjacent to the MDR and MSA sites include the following:

For MDR:

- Evaluate all data (both chemical and radiological) collected during and subsequent to removal action activities with respect to the contaminant distribution as presented in the Parcels E and F conceptual site models. This evaluation should include an assessment of remedial options for IR-02 and Areas 8, 9, and 10 in Parcel F.
- Continue to perform assessments of the stability of shoreline materials (i.e., sand) and develop a contingency plan in the event that significant erosion or migration occurs.
- Evaluate the future need and viability of the screening pad currently secured at MDR.
- Continue to inspect and maintain shoreline areas as part of the storm water pollution and protection program.

For MSA:

- Evaluate all data (both chemical and radiological) collected during and subsequent to removal action activities with respect to the contaminant distribution as presented in the Parcels E-2 and F conceptual site models. This evaluation should include an assessment of the remedial options for IR-01/21, South Basin, the Ship Shielding Range and adjacent soil berms, and the remainder of the panhandle area.
- Continue to perform assessments of the stability of shoreline materials (i.e., sand) and develop a contingency plan in the event that significant erosion or migration occurs.
- Perform the wetlands mitigation as presented in the project work plan. This mitigation is planned to be performed as part of a larger, comprehensive mitigation effort discussed in the IR-01/21 RI/FS.

12.0 REFERENCES

Atomic Energy Commission (AEC). 1974. *Regulatory Guide 1.86.*

California Department of Water Resources. 1991. *California Well Standards. Bulletin 74-90, Supplement to Bulletin 74-81.*

Department of Defense (DoD), Department of Energy (DOE), Nuclear Regulatory Commission (NRC), and U.S. Environmental Protection Agency (EPA). 2000. *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM). NUREG-1575. August.

Department of the Navy (DON), Southwest Division Naval Facilities Engineering Command. 2001a. *Final Basewide Radiological Removal Action, Action Memorandum for Hunters Point Shipyard.* November 19.

________________. 2001b. *Environmental Work Instruction (EWI) #1, 3EN2.1, Chemical Data Validation.*

Foster Wheeler Environmental Corporation, Inc. (FWENC). 2003. *Final Radiological Risk Communication Plan for Hunters Point Shipyard, San Francisco, California.* November 26.

Innovative Technical Solutions, Inc. (ITSI) and Tetra Tech, Inc. 2004. *Final Community Involvement Plan, Hunters Point Shipyard, San Francisco, California.* April 21.

Naval Sea Systems Command (NAVSEA). 2004. *Final Historical Radiological Assessment, Volume II.* History of the Use of General Radioactive Materials 1939–2003. August 31.

NAVSEA. 2005. *OP-5, Ammunition and Explosives Ashore Safety Regulations for Handling, Storage, Production, Renovation, & Shipping, Volume 1.*

San Francisco Redevelopment Agency (SFRA). 1997. Reuse Plan.

Tetra Tech EC, Inc. (TtEC). 2005a. *Final Removal Action Design and Implementation Work Plan, Metal Debris Reef and Metal Slag Areas, Parcels E and E-2 Hunters Point Shipyard, San Francisco CA.* November 10.

________________. 2006. *Final Basewide Radiological Removal Action, Action Memorandum - Revision 2006.* April 21.

Tetra Tech EMI, Inc. (TtEMI), Uribe and Associates (U&A), and Levine-Fricke-Recon, Inc. 1997. *Draft Final Parcel E Remedial Investigation Report, Hunters Point Shipyard, San Francisco, California.* October 27.

________________. 2002b. *Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) for Parcel E Standard Data Gaps Investigation, Hunters Point Shipyard, San Francisco, California.* August 22..

Tetra Tech FW, Inc (TtFW). 2004a. *Final Biological Assessment.* Parcel E, Hunters Point Shipyard, San Francisco, California. April 26.

____________________. 2004b. *Final Community Outreach Plan for Hunters Point Shipyard, San Francisco California*. June 7.

____________________. 2005b. *HPS Standard Operating Procedure* (SOP)-HPO-Tt-006, Radiation and Contamination Surveys.

U.S. Environmental Protection Agency (EPA). 1999. *Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA 54D/R-99/008.*

____________________. 2004. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 54D/R-04/004.*

TABLES

TABLE 2-1

METAL DEBRIS REEF PRE-EXCAVATION SEDIMENT RADIOLOGICAL RESULTS

				Cesium-137 (pCi/g) - Soil DCGL 1.3000E-01			Radium-226 (pCi/g) - Soil DCGL 2.000E+00			Strontium-90 (pCi/g) - Soil DCGL 4.230E+01		
Sample Location	**Sample Date**	**Sample Depth (feet bgs)**	**Sample Number**	**Net Activity**	**MDA**	**Uncertainty**	**Net Activity**	**MDA**	**Uncertainty**	**Net Activity**	**MDA**	**Uncertainty**
MR-01	7/27/04	**Composite**	**72-N-MR-01**	*<MDA	1.1175E-01	**	1.1584E+00	1.2904E+00	**			
			QA off site	*<MDA	2.6E-02	**	2.99E-01	4.7E-02	6.4E-02	*<MDA	2.36E-01	1.4E-01
MR-01	7/27/04	**0-1.2'**	**72-N-MR-001**	*<MDA	3.8643E-02	**	*<MDA	8.4820E-01	**			
MR-01	7/27/04	**3.8-5'**	**72-N-MR-002**	*<MDA	4.3659E-02	**	*<MDA	9.5829E-01	**			
MR-01	7/27/04	**7.5-8.8'**	**72-N-MR-1-003**	4.0887E-02	5.1949E-02	**	7.4902E-01	1.0926E+00	**			
MR-02	7/27/04	**Composite**	**72 Metal Reef MR 03**	*<MDA	3.3837E-02	**	*<MDA	9.9618E-01	**			
MR-02A	7/27/04	**0-1.2'**	**72-N-MR-1-004**	8.2768E-02	4.7795E-02	1.1691E-01	*<MDA	8.2779E-01	**			
			QA off site	*<MDA	5.8E-02	**	1.18E-01	9.6E-02	7.3E-02	2.5E-02	2.22E-01	1.2E-01
MR-02A	7/27/04	**3.5-4.7'**	**72-N-MR-1-005**	*<MDA	4.2854E-02	**	*<MDA	8.9961E-01	**			
MR-02A	7/27/04	**8.2-9.4'**	**72-N-MR-1-006**	1.1454E-01	4.4603E-02	9.9813E-02	6.3024E-01	1.0374E+00	**			
MR-03	7/27/04	**Composite**	**72 Metal Reef MR 03**	1.6397E-01	4.0627E-02	1.1487E-01	8.7298E-01	9.8910E-01	**			
MR-03	7/27/04	**0-1.2'**	**72-N-MR-1-010**	9.9563E-03	4.4608E-02	**	*<MDA	8.4340E-01	**			
MR-03	7/27/04	**3.7-4.9'**	**72-N-MR-1-011**	6.2009E-02	5.6304E-02	1.3443E-01	*<MDA	1.0825E+00	**			
MR-03	7/27/04	**8.4-9.6'**	**72-N-MR-1-012**	*<MDA	1.1548E-01	**	3.2748E+00†	1.5384E+00	3.5223E+00			
			QA off site	*<MDA	2.8E-02	**	2.42E-01	6.0E-02	6.5E-02	*<MDA	2.27E-01	1.3E-01
MR-04	7/28/04	**Composite**	**72 Metal Reef MR 04**	8.5808E-02	4.5205E-02	1.1691E-01	6.5525E-01	8.7240E-01	**			
MR-04	7/28/04	**0-1.3'**	**72-N-MR-1-016**	4.3197E-02	5.4683E-02	**	*<MDA	1.0387E+01	**			
			QA off site	*<MDA	6.2E-02	**	1.55E-01	9.5E-02	8.4E-02	1.2E-02	1.70E-01	8.7E-02
MR-04	7/28/04	**3.9-5.2'**	**72-N-MR-1-017**	*<MDA	4.8364E-02	**	8.3699E-01	1.3460E+00	**			
MR-04	7/28/04	**8.2-9.5'**	**72-N-MR-1-018**	*<MDA	4.6752E-02	**	1.0657E+00	1.0908E+00	**			
MR-04CS	7/28/04	**Composite**	**72 Metal Reef MR 04CS**	*<MDA	3.6724E-02	**	3.9127E-01	8.3780E-01	**			
MR-05	7/28/04	**Composite**	**72 Metal Reef MR 05**	*<MDA	3.8407E-02	**	3.4492E-01	7.5778E-01	**			
MR-05C	7/28/04	**Composite**	**72 Metal Reef MR 05C**	6.8099E-02	4.1448E-02	1.0015E-01	1.4578E+00	9.0789E-01	2.3377E+00			
MR-05C	7/28/04	**0-1.7'**	**72-N-MR-1-023**	7.7710E-02	5.0942E-02	1.1809E-01	7.6555E-01	9.7164E-01	**			
MR-05C	7/28/04	**3.1-4.7'**	**72-N-MR-1-024**	3.0016E-02	4.1621E-02	**	4.4215E-02	9.7154E-01	**			
MR-05E	7/28/04	**0-1.2'**	**72-N-MR-1-020**	6.0242E-02	5.0670E-02	1.0794E-01	1.9445E-02	9.9480E-01	**			
MR-05E	7/28/04	**3.7-4.9'**	**72-N-MR-1-021**	5.7051E-02	4.2167E-02	8.3185E-02	*<MDA	1.0636E+00	**			
MR-05E	7/28/04	**7.4-8.6'**	**72-N-MR-1-022**	*<MDA	4.3222E-02	**	*<MDA	1.2465E+00	**			
MR-06	9/14/04	**0-2.5'**	**72-N-MR-1-050**	*<MDA	2.8355E-02	**	4.3664E-01	7.1993E-01	**			
MR-06	9/14/04	**3-5'**	**72-N-MR-1-051**	*<MDA	2.9666E-02	**	1.3823E-01	7.3643E-01	**			
MR-06	9/14/04	**7.5-10'**	**72-N-MR-1-052**	5.5687E-02	2.8739E-02	6.7219E-02	1.5315E-01	6.8290E-01	**			
MR-07	9/13/04	**2.5-5'**	**72-N-MR-1-035**	2.1134E-02	3.7185E-02	**	8.0480E-01	6.5763E-01	1.1772E+00			
			QA off site	*<MDA	2.5E-02	**	9.39E-01	4.7E-02	1.5E-01	*<MDA	2.51E-01	1.2E-01
MR-07	9/13/04	**5-7.5'**	**72-N-MR-1-036**	2.5085E-02	3.2977E-02	**	1.4330E-02	8.9701E-01	**			
MR-07	9/13/04	**5-7.5'**	**72-N-MR-1-036**	4.0021E-03	2.7552E-02	**	*<MDA	6.7925E-01	**			
MR-08	9/15/04	**2.5-5'**	**72-N-MR-1-061**	1.1953E-02	3.3194E-02	**	*<MDA	8.5111E-01	**			
MR-08	9/15/04	**7.5-10'**	**72-N-MR-1-062**	6.7735E-02	3.0814E-02	7.4625E-02	2.6971E-01	7.5026E-01	**			
MR-08	9/15/04	**10-15'**	**72-N-MR-1-063**	*<MDA	2.3295E-02	**	*<MDA	7.6591E-01	**			
MR-09	9/13/04	**5-7.5'**	**72-N-MR-1-029**	3.5832E-02	2.8320E-02	6.4568E-02	*<MDA	6.0448E-01	**			
MR-09	9/13/04	**10-12.5'**	**72-N-MR-1-030**	8.2682E-02	2.3404E-02	5.9425E-02	*<MDA	6.8141E-01	**			
MR-09	9/13/04	**12.5-15'**	**72-N-MR-1-031**	*<MDA	2.7113E-02	**	8.4055E-02	6.9848E-01	**			
MR-10	9/13/04	**2.5-5'**	**72-N-MR-1-038**	5.1740E-03	4.8332E-02	**	*<MDA	1.0165E+00	**			
MR-10	9/13/04	**7.5-10'**	**72-N-MR-1-039**	7.1445E-02	2.6126E-02	6.7542E-02	2.2445E-01	6.1507E-01	**			
MR-10	9/13/04	**12-12.5'**	**72-N-MR-1-040**	*<MDA	3.4991E-02	**	*<MDA	8.3950E-01	**			
MR-11	9/14/04	**0-2.5'**	**72-N-MR-1-054**	*<MDA	3.9117E-02	**	*<MDA	1.0774E+00	**			
MR-11	9/14/04	**5-7.5'**	**72-N-MR-1-055**	*<MDA	2.9561E-02	**	1.5204E-01	7.7937E-01	**			
MR-11	9/14/04	**7.5-10'**	**72-N-MR-1-056**	6.6222E-02	2.6995E-02	5.4425E-02	*<MDA	7.7486E-01	**			
MR-12	9/14/04	**0-2.5'**	**72-N-MR-1-046**	*<MDA	3.0738E-02	**	2.1534E-01	8.7281E-01	**			
MR-12	9/14/04	**2.5-5'**	**72-N-MR-1-047**	4.5373E-02	3.1336E-02	6.4950E-02	5.9417E-02	6.9557E-01	**			
MR-12	9/14/04	**7.5-10'**	**72-N-MR-1-048**	4.4762E-02	3.7117E-02	1.0186E-01	*<MDA	6.9143E-01	**			
MR-13	9/13/04	**2.5-5'**	**72-N-MR-1-043**	7.5587E-02	4.6012E-02	1.2723E-01	3.6565E-01	8.7469E-01	**			
MR-13	9/13/04	**5-7.5'**	**72-N-MR-1-044**	3.1910E-02	3.6437E-02	**	4.7947E-01	9.4311E-01	**			
MR-13	9/13/04	**9.5-10'**	**72-N-MR-1-045**	4.2285E-02	3.4890E-02	8.4157E-02	*<MDA	7.3784E-01	**			
MR-14	9/15/04	**0-2.5'**	**72-N-MR-1-064**	7.6868E-02	4.1733E-02	1.0144E-01	*<MDA	9.1451E-01	**			
MR-14	9/15/04	**5-7.5'**	**72-N-MR-1-066**	2.1066E-02	3.2914E-02	**	*<MDA	7.5327E-01	**			
MR-14	9/15/04	**10-12.5'**	**72-N-MR-1-068**	6.9572E-02	2.9636E-02	7.1783E-02	*<MDA	6.8548E-01	**			
MR-15	9/14/04	**2.5-5'**	**72-N-MR-1-058**	*<MDA	5.0885E-02	**	2.1576E-01	1.1045E+00	**			
MR-15	9/14/04	**7.5-10'**	**72-N-MR-1-059**	*<MDA	3.1606E-02	**	3.2944E-01	7.4918E-01	**			
MR-15	9/14/04	**12-15'**	**72-N-MR-1-060**	*<MDA	2.3375E-02	**	*<MDA	6.8853E-01	**			

TABLE 2-1

METAL DEBRIS REEF PRE-EXCAVATION SEDIMENT RADIOLOGICAL RESULTS

				Isotopic Plutonium (pCi/g) - Soil DCGL 14.00E+00			Isotopic Uranium (pCi/g) - Soil DCGL 4.1700E-01		
Sample Location	Sample Date	Sample Depth (feet bgs)	Sample Number	Net Activity	MDA	Uncertainty	Net Activity	MDA	Uncertainty
MR-01	7/27/04	Composite	72-N-MR-01						
			QA off site	*<MDA	1.27E-01	3.3E-02	1.82E-01	2.1E-02	4.5E-02
MR-01	7/27/04	0-1.2'	72-N-MR-001						
MR-01	7/27/04	3.8-5'	72-N-MR-002						
MR-01	7/27/04	7.5-8.8'	72-N-MR-1-003						
MR-02	7/27/04	Composite	72 Metal Reef MR 03						
MR-02A	7/27/04	0-1.2'	72-N-MR-1-004						
			QA off site	*<MDA	2.80E-02	7E-03	2.29E-01	2.6E-02	5.5E-02
MR-02A	7/27/04	3.5-4.7'	72-N-MR-1-005						
MR-02A	7/27/04	8.2-9.4'	72-N-MR-1-006						
MR-03	7/27/04	Composite	72 Metal Reef MR 03						
MR-03	7/27/04	0-1.2'	72-N-MR-1-010						
MR-03	7/27/04	3.7-4.9'	72-N-MR-1-011						
MR-03	7/27/04	8.4-9.6'	72-N-MR-1-012						
			QA off site	*<MDA	2.59E-01	6.80E-02	3.24E-01	2.50E-02	5.90E-02
MR-04	7/28/04	Composite	72 Metal Reef MR 04						
MR-04	7/28/04	0-1.3'	72-N-MR-1-016						
			QA off site	1.7E-02	2.2E-02	1.7E-02	3.21E-01	2.0E-02	6.1E-02
MR-04	7/28/04	3.9-5.2'	72-N-MR-1-017						
MR-04	7/28/04	8.2-9.5'	72-N-MR-1-018						
MR-04CS	7/28/04	Composite	72 Metal Reef MR 04CS						
MR-05	7/28/04	Composite	72 Metal Reef MR 05						
MR-05C	7/28/04	Composite	72 Metal Reef MR 05C						
MR-05C	7/28/04	0-1.7'	72-N-MR-1-023						
MR-05C	7/28/04	3.1-4.7'	72-N-MR-1-024						
MR-05E	7/28/04	0-1.2'	72-N-MR-1-020						
MR-05E	7/28/04	3.7-4.9'	72-N-MR-1-021						
MR-05E	7/28/04	7.4-8.6'	72-N-MR-1-022						
MR-06	9/14/04	0-2.5'	72-N-MR-1-050						
MR-06	9/14/04	3-5'	72-N-MR-1-051						
MR-06	9/14/04	7.5-10'	72-N-MR-1-052						
MR-07	9/13/04	2.5-5'	72-N-MR-1-035						
			QA off site	*<MDA	1.59E-01	4.2E-02	4.11E-01	3.10E-02	7.60E-02
MR-07	9/13/04	5-7.5'	72-N-MR-1-036						
MR-07	9/13/04	5-7.5'	72-N-MR-1-036						
MR-08	9/15/04	2.5-5'	72-N-MR-1-061						
MR-08	9/15/04	7.5-10'	72-N-MR-1-062						
MR-08	9/15/04	10-15'	72-N-MR-1-063						
MR-09	9/13/04	5-7.5'	72-N-MR-1-029						
MR-09	9/13/04	10-12.5'	72-N-MR-1-030						
MR-09	9/13/04	12.5-15'	72-N-MR-1-031						
MR-10	9/13/04	2.5-5'	72-N-MR-1-038						
MR-10	9/13/04	7.5-10'	72-N-MR-1-039						
MR-10	9/13/04	12-12.5'	72-N-MR-1-040						
MR-11	9/14/04	0-2.5'	72-N-MR-1-054						
MR-11	9/14/04	5-7.5'	72-N-MR-1-055						
MR-11	9/14/04	7.5-10'	72-N-MR-1-056						
MR-12	9/14/04	0-2.5'	72-N-MR-1-046						
MR-12	9/14/04	2.5-5'	72-N-MR-1-047						
MR-12	9/14/04	7.5-10'	72-N-MR-1-048						
MR-13	9/13/04	2.5-5'	72-N-MR-1-043						
MR-13	9/13/04	5-7.5'	72-N-MR-1-044						
MR-13	9/13/04	9.5-10'	72-N-MR-1-045						
MR-14	9/15/04	0-2.5'	72-N-MR-1-064						
MR-14	9/15/04	5-7.5'	72-N-MR-1-066						
MR-14	9/15/04	10-12.5'	72-N-MR-1-068						
MR-15	9/14/04	2.5-5'	72-N-MR-1-058						
MR-15	9/14/04	7.5-10'	72-N-MR-1-059						
MR-15	9/14/04	12-15'	72-N-MR-1-060						

Notes:

* < MDA – Activity for this nuclide is less than the MDA.

** – Activity for this nuclide is less than the MDA; therefore, no uncertainty is necessary.

† – The apparent exceedance of radium-226 was found to not be present when an evaluation of the analytical spectrum and the high uncertainty was completed.

Abbreviations and Acronyms:

bgs – below ground surface
DCGL – derived concentration guideline level
MDA – minimum detectable activity
QA - quality assurance
pCi/g – picocurie per gram
Highlighted cells exceed RROs

TABLE 2-2

METAL SLAG AREA PRE-EXCAVATION SEDIMENT RADIOLOGICAL RESULTS

				Cesium-137 (pCi/g) - Soil DCGL 1.3000E-01			Radium-226 (pCi/g) - Soil DCGL 2.0000E+00			Strontium-90 (pCi/g) - Soil DCGL 1.230E+01		
Sample Location	**Sample Date**	**Sample Depth (feet bgs)**	**Sample Number**	**Net Activity**	**MDA**	**Uncertainty**	**Net Activity**	**MDA**	**Uncertainty**	**Net Activity**	**MDA**	**Uncertainty**
MS-01	**7/29/04**	**Composite**	**72 Metal Slag MS 01**	1.6370E-01	4.0301E-02	1.0927E-01	5.9033E-01	8.7532E-01	**			
MS-01	**7/29/04**	**0-1'**	**72-N-MS-1-011**	1.1625E-01	5.5635E-02	1.2892E-01	*<MDA	1.1399E+00	**			
MS-01	**7/29/04**	**3.1-4.2'**	**72-N-MS-1-012**	2.8663E-02	5.0767E-02	**	2.6392E-01	1.1748E+00	**			
MS-01	**7/29/04**	**8.6-9.6'**	**72-N-MS-1-013**	6.1676E-02	5.3658E-02	1.2811E-01	7.0009E-01	1.2262E+00	**			
MS-02	**7/29/04**	**Composite**	**72 Metal Slag MS 02**	*<MDA	5.8472E-02	**	*<MDA	9.9303E-01	**			
MS-02	**7/29/04**	**0-1.3'**	**72-N-MS-1-002**	1.5395E-01	6.2022E-02	1.4048E-01	*<MDA	1.4024E+00	**			
MS-02	**7/29/04**	**3.9-5.2'**	**72-N-MS-1-003**	9.0855E-02	8.2346E-02	2.0787E-01	*<MDA	1.3317E+00	**			
MS-02	**7/29/04**	**8.2-9.5'**	**72-N-MS-1-004**	*<MDA	6.3564E-02	**	*<MDA	1.1234E+00	**			
MS-03	**7/29/04**	**Composite**	**72 Metal Slag MS 03**	7.6467E-02	6.1505E-02	1.5631E-01	1.1264E+00	1.2609E+00	**			
MS-03	**7/29/04**	**0-1.2'**	**72-N-MS-1-015**	7.1257E-02	5.1088E-02	1.1311E-01	*<MDA	1.0650E+00	**			
			QA off site	*<MDA	7.5E-02	**	2.14E-01	1.31E-01	1.3E-01	*<MDA	2.22E-01	1.0E-01
MS-03	**7/29/04**	**3.5-4.7'**	**72-N-MS-1-016**	*<MDA	6.6812E-02	**	*<MDA	1.6012E+00	**			
MS-03	**7/29/04**	**8.4-9.6'**	**72-N-MS-1-017**	1.3443E-01†	6.7046E-02	1.7912E-01	*<MDA	1.4585E+00	**			
MS-04	**7/29/04**	**Composite**	**72 Metal Slag MS 04**	1.7333E-03	4.9934E-02	**	2.1746E+00	1.1123E+00	2.7000E+00			
MS-04	**7/29/04**	**0-1.4'**	**72-N-MS-1-008**	2.3227E-02	4.5360E-02	**	1.4511E-01	1.1467E+00	**			
MS-04	**7/29/04**	**4.3-5.7'**	**72-N-MS-1-009**	3.3817E-02	5.9289E-02	**	*<MDA	1.3928E+00	**			
MS-04	**7/29/04**	**8.1-9.6'**	**72-N-MS-1-010**	4.3950E-02	5.8700E-02	**	*<MDA	1.1270E+00	**			
MS-04CS	**7/29/04**	**Composite**	**72 Metal Slag MS 04CS**	*<MDA	4.9285E-02	**	8.2507E-01	1.0027E+00	**			
MS-05	**7/29/04**	**Composite**	**72 Metal Slag MS 05**	1.4288E-01†	5.9622E-02	1.6338E-01	1.0229E+00	1.2023E+00	**			
MS-05	**7/29/04**	**0-1'**	**72-N-MS-1-018**	*<MDA	5.2676E-02	**	*<MDA	1.3165E+00	**			
MS-05	**7/29/04**	**3.1-4.2'**	**72-N-MS-1-019**	2.6206E-03	6.7914E-02	**	*<MDA	1.1168E+00	**			
			QA off site	*<MDA	7.8E-02	**	2.92E-01	1.30E-01	1.5E-01	*<MDA	1.66E-01	7.8E-02
MS-05	**7/29/04**	**8.6-9.7'**	**72-N-MS-1-020**	4.1242E-02	6.8170E-02	**	*<MDA	1.2827E+00	**			
MS-06C	**9/10/04**	**0-2.5'**	**72-N-MS-1-067**	*<MDA	4.0005E-02	**	*<MDA	9.3114E-01	**			
MS-06C	**9/10/04**	**2.5-5'**	**72-N-MS-1-068**	4.7000E-02	3.4121E-02	7.8355E-02	*<MDA	7.3383E-01	**			
MS-06C	**9/10/04**	**10-12.5'**	**72-N-MS-1-069**	1.0054E-01	5.1566E-02	1.3929E-01	8.1139E-01	1.0195E+00	**			
			QA off site	*<MDA	4.2E-02	**	2.75E-01	8.8E-02	9.2E-02	*<MDA	2.80E-01	1.3E-01
MS-07A	**9/9/04**	**0-2.5'**	**72-N-MS-1-058**	8.7438E-02	4.5775E-02	1.2128E-01	4.7338E-01	8.7940E-01	**			
MS-07A	**9/9/04**	**5-7.5'**	**72-N-MS-1-059**	6.9729E-02	3.5604E-02	8.2539E-02	9.5182E-02	9.1690E-01	**			
MS-07A	**9/9/04**	**7.5-10'**	**72-N-MS-1-060**	*<MDA	4.7660E-02	**	*<MDA	1.1100E+00	**			
MS-08	**9/10/04**	**2.5-5'**	**72-N-MS-1-062**	2.8281E-02	5.2174E-02	**	*<MDA	1.1454E+00	**			
MS-08	**9/10/04**	**7.5-10'**	**72-N-MS-1-063**	9.1784E-03	7.0491E-02	**	*<MDA	1.7280E+00	**			
MD-08	**9/10/04**	**19.5-20'**	**72-N-MS-1-066**	*<MDA	8.2172E-02	**	*<MDA	2.0305E+00	**			
MS-9	**9/9/04**	**2.5-5'**	**72-N-MS-1-043**	*<MDA	2.8393E-02	**	2.4057E-01	7.5563E-01	**			
MS-9	**9/9/04**	**5-7.5'**	**72-N-MS-1-044**	3.1532E-02	3.2617E-02	**	*<MDA	8.0527E-01	**			
MS-9	**9/9/04**	**7.5-10'**	**72-N-MS-1-045**	5.1685E-02	3.1747E-02	6.8833E-02	1.3073E-01	7.0266E-01	**			
MS-10	**9/10/04**	**0-2.5'**	**72-N-MS-1-052**	6.6852E-02	4.6317E-02	1.0479E-01	3.6524E-01	1.0518E+00	**			
MS-10	**9/10/04**	**2.5-5'**	**72-N-MS-1-053**	*<MDA	3.6544E-02	**	*<MDA	1.0522E+00	**			
MS-10	**9/10/04**	**7.5-10'**	**72-N-MS-1-054**	5.2632E-02	3.7922E-02	9.6031E-02	*<MDA	8.4463E-01	**			
MS-11	**9/10/04**	**2-2.5'**	**72-N-MS-1-048**	9.6490E-02	6.0217E-02	1.4680E-01	*<MDA	1.2205E+00	**			
			QA off site	*<MDA	6.1E-02	**	2.88E-01	1.10E-01	1.0E-01	*<MDA	2.62E-01	1.3E-01
MS-11	**9/10/04**	**4.5-7.5'**	**72-N-MS-1-049**	1.1063E-02	3.5118E-02	**	*<MDA	7.3765E-01	**			
MS-11	**9/10/04**	**7.5-10'**	**72-N-MS-1-050**	*<MDA	3.6310E-02	**	1.1624E-01	9.6578E-01	**			
MS-12	**9/9/04**	**3-5'**	**72-N-MS-1-024**	5.0110E-02	3.3087E-02	7.2701E-02	1.7413E-02	7.3047E-01	**			
MS-12	**9/9/04**	**10-12.5'**	**72-N-MS-1-026**	3.2553E-02	5.3814E-02	**	*<MDA	1.1130E+00	**			
MS-12	**9/9/04**	**17.5-20'**	**72-N-MS-1-029**	*<MDA	9.9004E-02	**	*<MDA	2.5252E+00	**			
MS-13	**9/9/04**	**2.5-5'**	**72-N-MS-1-036**	8.1382E-03	2.8389E-02	**	3.2941E-01	6.9761E-01	**			
MS-13	**9/9/04**	**5-7.5'**	**72-N-MS-1-037**	*<MDA	6.1649E-02	**	2.0661E-01	1.2841E+00	**			
MS-13	**9/9/04**	**7.5-10'**	**72-N-MS-1-038**	3.9842E-02	4.5471E-02	**	*<MDA	8.0671E-01	**			
MS-14	**9/9/04**	**0-2.5'**	**72-N-MS-1-030**	2.1844E-01†	9.1961E-02	2.6147E-01	*<MDA	1.7564E+00	**			
			QA off site	*<MDA	1.19E-01	**	3.95E-01	7.4E-02	1.3E-01	*<MDA	2.44E-01	1.2E-01
MS-14	**9/9/04**	**5-7.5'**	**72-N-MS-1-031**	1.0726E-01	3.0590E-02	7.4316E-02	8.5908E-01	8.9965E-01	**			
MS-14	**9/9/04**	**7.5-10'**	**72-N-MS-1-032**	9.4600E-02	5.0344E-02	1.4391E-01	2.1070E-01	9.1436E-01	**			
MS-15	**9/10/04**	**2.5-5'**	**72-N-MS-1-070**	1.4984E-01	4.4564E-02	1.1787E-01	*<MDA	9.6326E-01	**			
			QA off site	7.5E-02	7.3E-02	6.8E-02	2.78E-01	1.5E-01	1.4E-01	5.0E-02	2.93E-01	1.6E-01
MS-15	**9/10/04**	**7.5-10'**	**72-N-MS-1-071**	1.1856E-01	4.2052E-02	1.1190E-01	2.2207E-02	9.5778E-01	**			
MS-15	**9/10/04**	**17.5-20'**	**72-N-MS-1-072**	5.9812E-02	5.8056E-02	1.4598E-01	5.8494E-01	1.2078E+00	**			

TABLE 2-2

METAL SLAG AREA PRE-EXCAVATION SEDIMENT RADIOLOGICAL RESULTS

				Isotopic Plutonium (pCi/g) - Soil DCGL 14.00E+00			Isotopic Uranium (pCi/g) - Soil DCGL 4.1700E-01		
Sample Location	Sample Date	Sample Depth (feet bgs)	Sample Number	Net Activity	MDA	Uncertainty	Net Activity	MDA	Uncertainty
MS-01	7/29/04	Composite	72 Metal Slag MS 01						
MS-01	7/29/04	0-1'	72-N-MS-1-011						
MS-01	7/29/04	3.1-4.2'	72-N-MS-1-012						
MS-01	7/29/04	8.6-9.6'	72-N-MS-1-013						
MS-02	7/29/04	Composite	72 Metal Slag MS 02						
MS-02	7/29/04	0-1.3'	72-N-MS-1-002						
MS-02	7/29/04	3.9-5.2'	72-N-MS-1-003						
MS-02	7/29/04	8.2-9.5'	72-N-MS-1-004						
MS-03	7/29/04	Composite	72 Metal Slag MS 03						
MS-03	7/29/04	0-1.2'	72-N-MS-1-015						
			QA off site	4.4E-02	1.68E-01	4.4E-02	4.43E-01	2.4E-02	7.9E-02
MS-03	7/29/04	3.5-4.7'	72-N-MS-1-016						
MS-03	7/29/04	8.4-9.6'	72-N-MS-1-017						
MS-04	7/29/04	Composite	72 Metal Slag MS 04						
MS-04	7/29/04	0-1.4'	72-N-MS-1-008						
MS-04	7/29/04	4.3-5.7'	72-N-MS-1-009						
MS-04	7/29/04	8.1-9.6'	72-N-MS-1-010						
MS-04CS	7/29/04	Composite	72 Metal Slag MS 04CS						
MS-05	7/29/04	Composite	72 Metal Slag MS 05						
MS-05	7/29/04	0-1'	72-N-MS-1-018						
MS-05	7/29/04	3.1-4.2'	72-N-MS-1-019						
			QA off site	*<MDA	4.3E-02	1.8E-02	3.74E-01	2.1E-02	6.9E-02
MS-05	7/29/04	8.6-9.7'	72-N-MS-1-020						
MS-06C	9/10/04	0-2.5'	72-N-MS-1-067						
MS-06C	9/10/04	2.5-5'	72-N-MS-1-068						
MS-06C	9/10/04	10-12.5'	72-N-MS-1-069						
			QA off site	*<MDA	3.8E-02	1.6E-02	3.42E-01	3.30E-02	6.7E-02
MS-07A	9/9/04	0-2.5'	72-N-MS-1-058						
MS-07A	9/9/04	5-7.5'	72-N-MS-1-059						
MS-07A	9/9/04	7.5-10'	72-N-MS-1-060						
MS-08	9/10/04	2.5-5'	72-N-MS-1-062						
MS-08	9/10/04	7.5-10'	72-N-MS-1-063						
MD-08	9/10/04	19.5-20'	72-N-MS-1-066						
MS-9	9/9/04	2.5-5'	72-N-MS-1-043						
MS-9	9/9/04	5-7.5'	72-N-MS-1-044						
MS-9	9/9/04	7.5-10'	72-N-MS-1-045						
MS-10	9/10/04	0-2.5'	72-N-MS-1-052						
MS-10	9/10/04	2.5-5'	72-N-MS-1-053						
MS-10	9/10/04	7.5-10'	72-N-MS-1-054						
MS-11	9/10/04	2-2.5'	72-N-MS-1-048						
			QA off site	1.6E-02	1.20E-01	3.1E-02	4.66E-01	2.9E-02	8.2E-02
MS-11	9/10/04	4.5-7.5'	72-N-MS-1-049						
MS-11	9/10/04	7.5-10'	72-N-MS-1-050						
MS-12	9/9/04	3-5'	72-N-MS-1-024						
MS-12	9/9/04	10-12.5'	72-N-MS-1-026						
MS-12	9/9/04	17.5-20'	72-N-MS-1-029						
MS-13	9/9/04	2.5-5'	72-N-MS-1-036						
MS-13	9/9/04	5-7.5'	72-N-MS-1-037						
MS-13	9/9/04	7.5-10'	72-N-MS-1-038						
MS-14	9/9/04	0-2.5'	72-N-MS-1-030						
			QA off site	*<MDA	1.27E-01	3.3E-02	3.64E-01	2.4E-02	7.1E-02
MS-14	9/9/04	5-7.5'	72-N-MS-1-031						
MS-14	9/9/04	7.5-10'	72-N-MS-1-032						
MS-15	9/10/04	2.5-5'	72-N-MS-1-070						
			QA off site	1.5E-02	4.5E-02	2.2E-02	4.15E-01	2.4E-02	7.8E-02
MS-15	9/10/04	7.5-10'	72-N-MS-1-071						
MS-15	9/10/04	17.5-20'	72-N-MS-1-072						

Notes:

* < MDA – Activity for this nuclide is less than the MDA.

** – Activity for this nuclide is less than the MDA; therefore, no uncertainty is necessary.

† – The apparent exceedances of cesium-137 was found to not be present when an evaluation of the analytical spectrum and the high uncertainty was completed.

Abbreviations and Acronyms:

bgs – below ground surface
DCGL – derived concentration guideline level
MDA – minimum detectable activity
QA - quality assurance
pCi/g – picocurie per gram
Highlighted cells exceed RROs

TABLE 2-3

RADIOLOGICAL REMEDIAL OBJECTIVES AND RELEASE CRITERIA

Radionuclide	Half-life	Radiations	Surfaces		Soil[a] (pCi/g)		Liquid[f] (pCi/L)
			Equipment, Waste (dpm/100 cm^2)[b]	Residual Dose (mrem/yr)[c]	Outdoor Worker (pCi/g)[d]	Residual Dose (mrem/yr)[c]	
Cesium-137	30 years	Beta/gamma (β-,γ)	5,000	1.72	0.113	0.2142	119
Radium-226	1,600 years	Alpha (α)/gamma (γ)	100	0.612	1.0[e]	6.342	5[g]
Strontium-90	28.6 years	Beta (β-)	1,000	0.685	10.8	0.1931	8

Notes:

a EPA PRGs for two future-use scenarios.

b These limits are based on AEC *Regulatory Guide 1.86* (1974). Limits for removable surface activity are 20 percent of these values.

c The resulting dose is based on modeling using RESRAD-Build Version 3.3 or RESRAD Version 6.3, with radon pathways turned off.

d The on-site and off-site laboratory will ensure that the MDA meets the listed release criteria by increasing sample size or counting time as necessary. The MDA is defined as the lowest net response level, in counts, that can be seen with a fixed level of certainty, customarily 95 percent. The MDA is calculated per sample by considering background counts, amount of sample used, and counting time.

e Limit is 1 pCi/g above background, per agreement with EPA.

f Release criteria for liquids have been derived from *Radionuclides Notice of Data Availability Technical Document* (EPA, 2000) by comparing the limits from two criteria and using the most conservative limit.

g Limit is for total radium concentration.

Abbreviations and Acronyms:

AEC – Atomic Energy Commission
cm^2 – square centimeters
dpm – disintegrations per minute
EPA – U.S. Environmental Protection Agency
MDA – minimum detectable activity
mrem/yr – millirem per year
pCi/g – picocurie per gram
pCi/L – picocurie per liter
PRG – preliminary remediation goal
Types of radiation: α - alpha, β - beta, γ - gamma

TABLE 4-1

UXO LOG

Line Number	Date Found	UXO ID Number	Site	Item Description	UXO Category *
1	06/29/05	UXO-0001	Metal Reef	5 in Casing	3X
2	06/29/05	UXO-0002	Metal Reef	3 in Casing	3X
3	06/29/05	UXO-0003	Metal Reef	40 mm Casing	3X
4	06/29/05	UXO-0004	Metal Reef	40 mm Casing	3X
5	06/30/05	UXO-0005	Metal Reef	5 in Casing	5X
6	06/30/05	UXO-0006	Metal Reef	5 in Protective Cap	5X
7	07/05/05	UXO-0007	Metal Reef	40 mm Casing	5X
8	07/07/05	UXO-0010	Metal Reef	40 mm Casing	5X
9	07/12/05	UXO-0011	Metal Reef	40 mm Casing	5X
10	07/13/05	UXO-0012	Metal Reef	40 mm Casing	3X
11	07/14/05	UXO-0015	Metal Reef	5 in Casing	5X
12	07/14/05	UXO-0016	Metal Reef	40 mm Casing	5X
13	07/15/05	UXO-0017	Metal Reef	40 mm Casing	5X
14	07/18/05	UXO-0018	Metal Reef	40 mm Casing	3X
15	07/18/05	UXO-0020	Metal Reef	.50 cal Casing	5X
16	07/20/05	UXO-0022	Metal Reef	.50 cal Casing	5X
17	07/20/05	UXO-0024	Metal Reef	20 mm Casing	5X
18	07/21/05	UXO-0026	Metal Reef	20 mm Casing	5X
19	07/21/05	UXO-0027	Metal Reef	5.56 mm Casing	5X
20	07/22/05	UXO-0028	Metal Reef	20 mm Casing	5X
21	07/22/05	UXO-0029	Metal Reef	40 mm Casing	3X
22	07/23/05	UXO-0030	Metal Reef	40 mm Casing	3X
23	07/24/05	UXO-0031	Metal Reef	20 mm Casing	3X
24	07/24/05	UXO-0032	Metal Reef	7.62 mm Full Up	5X
25	07/27/05	UXO-0036	Metal Reef	40 mm Casing	5X
26	07/27/05	UXO-0037	Metal Reef	40 mm Casing	5X
27	07/28/05	UXO-0038	Metal Reef	20 mm Casing	5X
28	08/01/05	UXO-0049	Metal Reef	3 in Casing	5X
29	08/01/05	UXO-0050	Metal Reef	5 in Casing	5X
30	08/02/05	UXO-0053	Metal Reef	40 mm Casing	3X
31	08/02/05	UXO-0054	Metal Reef	3 in Casing	5X
32	08/03/05	UXO-0055	Metal Reef	7.62 mm Casing	5X
33	08/03/05	UXO-0056	Metal Reef	40 mm Casing	5X
34	08/04/05	UXO-0058	Metal Reef	40 mm Casing	3X
35	09/09/05	UXO-0117	Metal Reef	40 mm Casing	5X
36	09/12/05	UXO-0118	Metal Reef	40 mm Casing	5X
37	09/12/05	UXO-0122	Metal Reef	7.62 mm Casing	5X
38	09/13/05	UXO-0127	Metal Reef	3 in Casing	5X
39	09/13/05	UXO-0128	Metal Reef	40 mm Casing	5X
40	09/13/05	UXO-0131	Metal Reef	20 mm Casing	3X
41	09/13/05	UXO-0132	Metal Reef	20 mm Casing	3X
42	09/13/05	UXO-0133	Metal Reef	20 mm Casing	5X
43	09/13/05	UXO-0137	Metal Reef	5 in Casing	5X
44	09/15/05	UXO-0139	Metal Reef	5 in Casing	3X
45	09/16/05	UXO-0145	Metal Reef	20 mm Casing	5X
46	09/29/05	UXO-0158	Metal Reef	40 mm Casing	5X
47	09/29/05	UXO-0159	Metal Reef	5 in Casing	5X
48	09/29/05	UXO-0160	Metal Reef	5 in Casing	5X

TABLE 4-1

UXO LOG

Line Number	Date Found	UXO ID Number	Site	Item Description	UXO Category *
49	09/30/05	UXO-0165	Metal Reef	5 in Casing	5X
50	09/30/05	UXO-0166	Metal Reef	5 in Protective Cap	5X
51	09/30/05	UXO-0169	Metal Reef	5 in Casing	3X
52	10/03/05	UXO-0170	Metal Reef	5 in Protective Cap	5X
53	10/04/05	UXO-0173	Metal Reef	30-06 Bullet	5X
54	10/04/05	UXO-0176	Metal Reef	20 mm Casing	5X
55	10/07/05	UXO-0182	Metal Reef	40 mm Casing	5X
56	10/07/05	UXO-0183	Metal Reef	5 in Casing	5X
57	10/07/05	UXO-0186	Metal Reef	40 mm Casing	3X
58	10/10/05	UXO-0190	Metal Reef	40 mm Casing	3X
59	10/10/05	UXO-0191	Metal Reef	3 in Casing	3X
60	10/11/05	UXO-0194	Metal Reef	40 mm Casing	5X
61	10/12/05	UXO-0195	Metal Reef	5 in Casing	3X
62	07/24/05	UXO-0033	Metal Slag	5 in Casing	5X

Notes:

* MPPEH identified during activities were segregated using two categories:

1) 3X (possibly contains an explosive hazard)
2) 5X (contains no hazards)

Abbreviations and Acronyms:

cal – caliber
ID – identification
in – inch
mm – millimeter
MPPEH – material potentially presenting an explosive hazard
UXO – unexploded ordnance

TABLE 4-2

DERIVED AIRBORNE CONCENTRATION

Radionuclide	Worker	
	DAC (μCi/mL)	10% DAC (μCi/mL)
Radium-226	3.0E-10	3.0E-11
Strontium-90	8.0E-9	8.0E-10
Cesium-137	6.0E-8	6.0E-9

Notes:

The above guideline values were determined using the NRC's 10 CFR, Part 20, Appendix B.

Abbreviations and Acronyms:

μCi/mL – microcurie per milliliter (concentration)
CFR – Code of Federal Regulations
DAC – derived air concentration
NRC – Nuclear Regulatory Commission

TABLE 4-3

INSTRUMENTATION FOR RADIOLOGICAL SURVEYS

Measurement/ Technique	Type of Instrumentation		Typical Background	Typical Total Efficiency (%)	Detection Sensitivity
	Detector Type and Ludlum Model Number(s)	Meter Description and Ludlum Model Number(s)			
Surface alpha/beta scans and/or direct measurement static alpha/beta	Large-area gas proportional 43-68 ($126\ cm^2$)	Data logger 2350-1, 2360	150-250 cpm β 0-2 cpm α	~6 β total efficiency ~6 α total efficiency	~ 900 dpm/100 cm^2 β ~ 100 dpm/100 cm^2 α
Direct measurement static alpha/beta	Scintillation, Ludlum Model 43-89 ($100\ cm^2$)		100-200 cpm β 0-5 cpm α		
Surface gamma scans	NaI 2-inch x 2-inch scintillation Ludlum Model 44-10	Data logger 2350-1, 4612	100 to 12,000 cpm; varies with calibration γ	N/A	150 – 1,500 cpm γ
Direct measurement static gamma					
Surface beta/ gamma scans	Geiger-Mueller Ludlum Model 44-9	Ratemeter 3	50 to 100 cpm $\beta\gamma$	~10 $\beta\gamma$ total efficiency	~ 1,000 dpm per probe area $\beta\gamma$
Direct measurement static beta/gamma					
Exposure rates	MicroR Meter with integral 1-inch x 1-inch NaI scintillation	Ratemeter 19	7-8 μR/hr	N/A	2 μR/hr

Abbreviations and Acronyms:

α – alpha
β – beta
γ – gamma
μR/hr – microroentgen per hour
cm^2 – square centimeters
cpm – counts per minute
dpm – disintegrations per minute
N/A – not applicable
NaI – sodium iodide

TABLE 4-4

ON-SITE AND OFF-SITE POST EXCAVATION LIMITED TRENCH SAMPLES

QA Analysis Comparison														
Sample ID	Location	On-site Laboratory						Off-site Laboratory (QA)						
		^{137}Cs			^{226}Ra			Count Time (min)	^{137}Cs			^{226}Ra		
		Activity	MDA	3σ Error	Activity	MDA	3σ Error		Activity	MDA	2σ Error	Activity	MDA	2σ Error
72-N-MDR-G-121-LT-PE-001	Grid 121	0.000	0.051	0.000	-0.139	1.210	-2.629	246	U	0.060	N/A	U	0.982	N/A
72NMDRLTG118PE-1	Grid 117	0.052	0.039	0.088	1.153	0.735	1.424	217	U	0.056	N/A	0.626	0.746	0.610
72NMSA-LT-G43-PE-1	Grid 43	0.029	0.044	0.085	1.356	0.886	1.665	292	U	0.103	N/A	U	1.030	N/A
72NMSA-LT-G64-PE-1	Grid 64	0.038	0.039	0.077	1.071	0.870	1.612	202	U	0.068	N/A	U	1.460	N/A
72NMSALTG69PE-1	Grid 69	0.058	0.034	0.076	1.419	0.704	1.374	239	U	0.043	N/A	0.653	0.811	0.640
72NMSALTG71PE-1	Grid 71	0.159	0.038	0.729	1.019	0.053	0.984	208	0.080	0.068	0.063	U	1.220	N/A
72NMSALTG74PE-2	Grid 74	0.133	0.047	0.120	0.658	0.962	1.736	212	U	0.074	N/A	U	0.792	N/A
72NMSALTG92PE-1	Grid 92	0.025	0.041	0.090	1.291	0.760	1.497	229	U	0.054	N/A	1.290	0.713	0.740
72-N-MSA-G97-LT-PE-001	Grid 97	0.012	0.052	0.074	1.650	1.190	2.218	222	U	0.067	N/A	U	0.727	N/A
72NMSAG103LTPE-001	Grid 103	-0.055	0.042	-1.126	0.524	0.765	1.383	911	U	0.021	N/A	0.238	0.038	0.074

Notes:

Exceedances indicated by red text

Abbreviations and Acronyms:

^{137}Cs – cesium-137
^{226}Ra – radium-226
MDA – minimum detectable activity
min – minutes
N/A – 2 sigma error not reported since the activity was less than MDA
pCi/g – picocurie per gram
U – activity not reported since it was less than MDA

TABLE 4-5

ON-SITE AND OFF-SITE POST EXCAVATION SIDEWALL SAMPLES

QA Analysis Comparison															
Sample ID	Location	On-site Laboratory						Off-site Laboratory (QA)							
		^{137}Cs			^{226}Ra			Count Time (min)	^{137}Cs			^{226}Ra			
		Activity	MDA	3σ Error	Activity	MDA	3σ Error		Activity	MDA	2σ Error	Activity	MDA	2σ Error	
72NMDRSWG95PE-2	Grid 95	-0.052	0.039	-1.077	1.231	0.891	1.731	219	U	0.058	N/A	U	0.752	N/A	
72NMDRSWG99PE-001	Grid 99	0.021	0.046	0.104	-0.099	0.755	-1.875	185	U	0.058	N/A	U	1.150	N/A	
72NMDRSWG101PE-001	Grid 101	0.060	0.031	0.072	0.846	0.697	1.308	187	U	0.056	N/A	U	0.831	N/A	
72NMDRSWG102-PE-1	Grid 102	-0.042	0.032	-0.287	0.861	0.536	1.096	200	U	0.046	N/A	U	0.650	N/A	
72NMDRSWG112-PE-1	Grid 112	-0.115	0.562	-1.412	0.744	0.794	1.412	202	U	0.058	N/A	U	1.040	N/A	
72-N-MSA-G68-SW-PE-001	Grid 68	0.138	0.035	0.089	0.712	0.786	1.419	222	0.114	0.040	0.039	U	0.571	N/A	
72NMSAG85ASWPE-001	Grid 85	0.007	0.043	0.064	1.417	0.868	1.647	949	U	0.023	N/A	0.369	0.045	0.092	
72NMSAG116ASWAPE-001	Grid 116	0.015	0.033	0.063	0.435	0.863	1.522	469	U	0.028	N/A	U	0.139	N/A	

Notes:

Exceedances indicated by red text

Abbreviations and Acronyms:

^{137}Cs – cesium-137
^{226}Ra – radium-226
MDA – minimum detectable activity
min – minutes
N/A – 2 sigma error not reported since the activity was less than MDA
pCi/g – picocurie per gram
U – activity not reported since it was less than MDA

TABLE 4-6

ON-SITE AND OFF-SITE POST EXCAVATION RANDOM GRID SAMPLES

QA Analysis Comparison													
Sample ID	Location	On-site Laboratory						Off-site Laboratory (QA)					
		^{137}Cs			^{226}Ra			Count Time (min)	^{137}Cs			^{226}Ra	
		Activity	MDA	3σ Error	Activity	MDA	3σ Error		Activity	MDA	2σ Error	Activity	MDA	2σ Error
72-N-MDR-G92-PE-001	Grid 94	-0.041	0.052	-0.336	-0.061	1.110	-2.153	212	U	0.042	N/A	U	0.763	N/A
72NMDRG100PE-001	Grid 100	-0.055	0.037	146.990	0.681	0.756	1.385	513	U	0.054	N/A	U	0.988	N/A
72-N-MDR-SU2-RSP-PE-003	Grid 106	0.090	0.041	0.094	-0.476	1.090	-4.679	694	U	0.030	N/A	0.521	0.458	0.040
72NMSAG061PE-002	Grid 61	-0.039	0.028	-0.397	1.054	0.581	1.150	265	U	0.070	N/A	U	1.340	N/A
72NMSAG99PE-001	Grid 99	0.038	0.038	0.063	1.045	0.736	1.380	627	U	0.061	N/A	0.200	0.066	0.100

Abbreviations and Acronyms:
^{137}Cs – cesium-137
^{226}Ra – radium-226
MDA – minimum detectable activity
min – minutes
N/A – 2 sigma error not reported since the activity was less than MDA
pCi/g – picocurie per gram
U – activity not reported since it was less than MDA

TABLE 4-7

ON-SITE AND OFF-SITE EXCAVATION SYSTEMATIC GRID SAMPLES

QA Analysis Comparison														
Sample ID	Location	On-site Laboratory						Off-site Laboratory (QA)						
		^{137}Cs			^{226}Ra			Count Time (min)	^{137}Cs			^{226}Ra		
		Activity	MDA	3σ Error	Activity	MDA	3σ Error		Activity	MDA	2σ Error	Activity	MDA	2σ Error
72NMDR-SU1-A3-PE-004	Grid 92	-0.012	0.035	-0.090	0.688	0.513	0.995	210	U	0.055	N/A	0.841	0.653	0.540
72NMDR-SU1-A4-PE-005	Grid 92	0.069	0.047	0.104	0.956	0.626	1.230	694	U	0.022	N/A	0.372	0.355	0.320
72NMDR-SU2-B0-PE-001	Grid 108	0.077	0.036	0.089	0.968	0.755	1.394	209	U	0.033	N/A	U	0.631	N/A
72NMDR-SU3-A4-PE-002	Grid 105	0.027	0.041	0.064	1.026	0.795	1.492	203	U	0.063	N/A	U	0.798	N/A
72NMDR-SU3-A4-PE-012	Grid 105	0.070	0.029	0.066	0.245	0.869	1.523	204	U	0.056	N/A	0.721	0.735	0.580
72NMDRSU3A5-PE-1	Grid 94	0.045	0.039	0.090	-0.073	0.778	-1.602	223	U	0.051	N/A	U	0.803	N/A
72NMDR-SU3-B1-PE-005	Grid 121	0.004	0.013	0.024	0.934	0.913	1.645	694	U	0.033	N/A	U	0.553	N/A
72NMDRSU4A4PE-1	Grid 103	-0.021	0.031	-0.130	0.648	0.663	1.243	202	U	0.055	N/A	U	1.770	N/A
72NMDRSU4B4PE-002	Grid 103	-0.040	0.037	-0.420	1.353	0.628	1.248	187	U	0.071	N/A	U	0.898	N/A
72NMDRSU4C2PE-1	Grid 119	0.100	0.019	0.075	0.798	0.654	1.269	210	U	0.048	N/A	U	0.895	N/A
72NMDRSU5A5PE-1	Grid 101	0.022	0.046	0.093	0.196	0.750	1.335	708	U	0.026	N/A	0.366	0.304	0.300
72NMDRSU5B4PE-001	Grid 113	-0.072	0.044	-1.262	0.991	0.895	1.668	191	U	0.058	N/A	U	1.310	N/A
72NMDRSU6A2PE-1	Grid 114	-0.004	0.037	-0.065	1.320	0.786	1.559	224	U	0.041	N/A	U	1.080	N/A
72NMDRSU6C0PE-1	Grid 116	0.095	0.013	0.064	1.091	0.912	1.757	205	U	0.071	N/A	U	0.873	N/A
72NMDRSU7B4PE-1	Grid 99-1	-0.002	0.040	-0.072	0.148	0.869	1.547	709	U	0.031	N/A	0.688	0.498	0.440
72NMDRSU7B5PE-1	Grid 99-1	0.042	0.011	0.043	1.577	0.639	1.341	229	U	0.052	N/A	U	0.772	N/A
72-MSASU1A2-002	Grid 110	-0.025	0.057	-0.156	0.740	0.835	1.488	225	U	0.077	N/A	0.511	0.137	0.160
72-N-MSA-SU1-A3-PE-001	Grid 110	0.098	0.021	0.090	0.358	1.020	1.778	222	U	0.076	N/A	U	1.270	N/A
72NMSA-SU3A2-PE-1	Grid 89	0.028	0.041	0.070	0.263	1.050	1.843	220	U	0.077	N/A	U	1.560	N/A
72-N-MSA-SU4-A0-PE-001	Grid 103	-0.044	0.065	-0.383	1.391	0.925	1.762	200	U	0.063	N/A	1.140	1.060	0.870
72-N-MSA-SU4-C0-PE-001	Grid 86	0.014	0.032	0.061	1.844	0.581	1.153	203	U	0.045	N/A	1.000	0.896	0.710
72-N-MSA-SU5-A3-PE-001	Grid 60	0.113	0.051	0.119	0.742	1.150	2.069	222	U	0.037	N/A	U	0.985	N/A
72-N-MSA-SU5-A5-PE-001	Grid 61	0.169	0.009	0.078	0.366	1.090	1.917	203	U	0.101	N/A	1.740	0.941	0.850
72-N-MSA-SU5-B1-001	Grid 74	0.099	0.011	0.064	1.211	1.290	2.342	203	U	0.044	N/A	U	0.760	N/A

Notes:

Exceedances indicated by red text

Abbreviations and Acronyms:

^{137}Cs – cesium-137
MDA – minimum detectable activity
min – minutes
N/A – 2 sigma error not reported since the activity was less than MDA
pCi/g – picocurie per gram
^{226}Ra – radium-226
U – activity not reported since it was less than MDA

TABLE 6-1

MDR/MSA EXCAVATION SITES
SUMMARY OF WASTE MATERIALS

Material	Quantity
Total Contaminated Soil and Debris	18,010 cy
Excavated Large Debris	1,050 cy[a]
Over-pack Drums	35 drums
LLMW	1 drums
LLRW	1,700 cy
LLRW – Radiological Point Sources	77 devices 63 buttons 23 pieces of debris
Wastewater/Decontamination Water	12,000 gallons[a]
Compressed Gas Cylinders	28 cylinders
Metal Debris	61 cy[a]

Notes:

[a] Estimated value

Abbreviations and Acronyms:

cy – cubic yard
LLMW – low-level mixed waste
LLRW – low-level radiological waste

TABLE 9-1

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR PCBs

Sample Number	Cooler Temperature[a]	Continuing Calibration[b]	Surrogate[c]	MS/MSD[d]
72-MDR-1002		X		
72-MDR-1003		X	X	
72-MDR-1010				X
72-MDR-1013			X	
72-MDR-1016			X	
72-MDR-1020			X	
72-MSA-1003			X	
72-MSA-1005		X		
72-MSA-1006	X	X		
72-MSA-1009				X
72-MSA-1010			X	
72-MSA-1013		X		

Notes:

[a] Cooler temperature did not meet the QC requirement for checked samples. Therefore, these samples were flagged "J/UJ".

[b] %D of continuing calibration did not meet the QC requirement for checked samples. Therefore, these samples were flagged "J/UJ".

[c] Surrogate %R were outside of QC limits for checked samples. Therefore, these samples were flagged "J".

[d] %R or RPDs outside of the QC limits for checked samples. Therefore, these samples were flagged "J/UJ".

Abbreviations and Acronyms:

%D – percent difference
%R – percent recovery
J – estimated value
MS – matrix spike
MSD – matrix spike duplicate
PCB – polychlorinated biphenyl
QC – quality control
RPD – relative percent difference
U – analyte not detected above project reporting limit

TABLE 9-2

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR PESTICIDES

Sample Number	Cooler Temperature[a]	Initial Calibration[b]	Continuing Calibration[c]	Laboratory Control Samples[d]	MS/MSD[e]	Compound Quantitation[f]
72-MDR-1000			X			X
72-MDR-1001		X	X		X	
72-MDR-1002		X	X		X	
72-MDR-1003		X	X			
72-MDR-1010		X	X			X
72-MDR-1011		X	X	X		X
72-MDR-1012		X	X	X		X
72-MDR-1013		X	X	X		X
72-MDR-1014		X	X			X
72-MDR-1015		X	X			X
72-MDR-1016			X			X
72-MDR-1017			X			X
72-MDR-1018			X			
72-MDR-1019			X			X
72-MDR-1020			X			X
72-MDR-1021			X			
72-MDR-1022			X			X
72-MDR-1023			X			X
72-MSA-1000		X	X	X		X
72-MSA-1001		X	X	X		
72-MSA-1002		X		X	X	
72-MSA-1003			X			X
72-MSA-1004			X		X	X
72-MSA-1005			X			X
72-MSA-1006	X		X			X
72-MSA-1007		X	X			X
72-MSA-1008		X	X			X
72-MSA-1009		X	X	X		X
72-MSA-1010		X	X	X		
72-MSA-1011		X	X	X		
72-MSA-1012		X	X			
72-MSA-1012A			X			
72-MSA-1013		X	X			
72-MSA-1013A			X			
72-MSA-1014			X			X
72-MSA-1014A			X			
72-MSA-1015			X			X
72-MSA-1015A			X			
72-MSA-1016			X			
72-BACKFILL-053			X			
72-BACKFILL-054			X			

TABLE 9-2

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR PESTICIDES

Sample Number	Cooler Temperature[a]	Initial Calibration[b]	Continuing Calibration[c]	Laboratory Control Samples[d]	MS/MSD[e]	Compound Quantitation[f]
72-BACKFILL-055			X			
72-BACKFILL-056			X			
72-BACKFILL-057			X			

Notes:

[a] Cooler temperature did not meet the QC requirement for checked samples. Therefore, these samples were flagged "J/UJ".

[b] RSDs of initial calibration did not meet the QC requirement for checked samples. Therefore, these samples were flagged "J/UJ".

[c] %D of continuing calibration did not meet the QC requirement for checked samples. Therefore, these samples were flagged "J/UJ".

[d] %R or RPDs outside of the QC limits for checked samples. Therefore, these samples were flagged "J/UJ".

[e] RPD outside of the QC limits for checked samples. Therefore, these detected samples were flagged "J".

[f] The sample results for detected compounds from the two columns were outside of the 40% RPD criteria.

Abbreviations and Acronyms:

J – estimated value
MS – matrix spike
MSD – matrix spike duplicate
%D – percent difference
%R – percent recovery
QC – quality control
RPD – relative percent difference
RSD – relative standard deviation
U – analyte not detected above project reporting limit

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-MDR-1000	X				
72-MDR-1001	X		X		
72-MDR-1002	X	X	X		
72-MDR-1003	X	X	X		
72-MDR-1010	X	X	X		
72-MDR-1011	X	X	X		
72-MDR-1012		X	X		
72-MDR-1013		X	X		
72-MDR-1016			X		
72-MDR-1017	X		X		
72-MDR-1018	X		X		
72-MDR-1019			X		
72-MDR-1020	X		X		
72-MDR-1021			X		
72-MDR-1022	X		X		
72-MSA-1000	X		X		
72-MSA-1001			X		
72-MSA-1002	X				
72-MSA-1003			X		
72-MSA-1004			X		
72-MSA-1005			X		
72-MSA-1007	X		X		
72-MSA-1008			X		
72-MSA-1009	X		X		
72-MSA-1010			X		
72-MSA-1011			X		
72-MSA-1012	X		X		
72-MSA-1012A	X				
72-MSA-1013A	X				
72-MSA-1014			X		
72-MSA-1014A		X	X		
72-MSA-1015	X		X		
72-MSA-1015A		X	X		
72-MSA-1016		X	X		
72-BACKFILL-053	X	X	X		
72-BACKFILL-054	X	X	X		
72-BACKFILL-055	X	X	X		
72-BACKFILL-056	X	X	X		
72-BACKFILL-057	X	X	X		
72-MDR-006	X		X		

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS
FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-MDR-008	X		X		
72-MDR-009	X		X		
72-MDR-010	X		X		
72-MDR-011			X		
72-MDR-013	X		X		
72-MDR-014	X		X		
72-MDR-018	X	X	X		
72-MDR-019	X		X		
72-MDR-020	X		X		
72-MDR-021	X		X		
72-MDR-023			X		
72-MDR-024			X		
72-MDR-025			X		
72-MDR-026	X		X		
72-MDR-027	X		X		
72-MDR-028	X		X		
72-MDR-029	X		X		
72-MDR-030	X		X		
72-MDR-031	X		X		
72-MDR-032	X		X		
72-MDR-033	X		X		
72-MDR-034			X		
72-MDR-035	X		X		
72-MDR-036	X		X		
72-MDR-037	X		X		
72-MDR-038	X		X		
72-MDR-039	X		X		
72-MDR-040	X		X		
72-MDR-041			X		
72-MDR-042			X		
72-MDR-043	X				
72-MDR-044	X				X
72-MDR-045					X
72-MDR-046					X
72-MDR-047					X
72-MDR-048	X		X		
72-MDR-049	X		X		
72-MDR-050	X		X		
72-MDR-051	X				
72-MDR-052	X		X		

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS
FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-MDR-053	X		X		
72-MDR-054	X		X		
72-MDR-055	X		X		
72-MDR-056	X		X		
72-MDR-057	X		X		
72-MDR-058	X		X		
72-MDR-059	X		X		
72-MDR-060	X		X		
72-MDR-061	X		X		
72-MDR-062	X		X		
72-MDR-063	X		X		
72-MDR-064	X		X		
72-MDR-065	X	X	X		
72-MDR-066	X	X	X		
72-MDR-067	X	X	X		
72-MDR-068	X	X	X		
72-MDR-069	X		X		
72-MDR-070			X		
72-MDR-071			X		
72-MDR-072	X		X		X
72-MDR-073	X		X		X
72-MDR-074			X		X
72-MDR-075			X		
72-MDR-076	X		X		
72-MDR-077	X		X		
72-MDR-078	X		X		
72-MDR-079	X				
72-MDR-080	X				
72-MDR-081			X		
72-MDR-082			X		
72-MDR-083	X		X		
72-MDR-084			X		
72-MDR-085	X				
72-MDR-086	X				
72-MDR-087	X		X		
72-MDR-088			X		
72-MDR-089	X		X		
72-MDR-090	X		X		
72-MDR-091	X		X		
72-MDR-092	X		X		

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-MDR-093	X		X		
72-MDR-094	X		X		X
72-MDR-095	X		X		X
72-MDR-096	X		X		X
72-MDR-097	X		X		X
72-MDR-098	X		X		
72-MDR-099	X		X		
72-MDR-100	X		X		
72-MDR-101	X		X		
72-MDR-102	X		X		
72-MDR-103	X		X		
72-MDR-104	X		X		
72-MDR-105	X		X		
72-MDR-106	X		X		
72-MDR-107	X		X		
72-MDR-108	X		X		
72-MDR-109	X		X		
72-MDR-110	X		X		
72-MDR-111	X		X		
72-MDR-112	X		X		
72-MDR-113	X		X		
72-MDR-114	X		X		
72-MDR-115	X		X		
72-MDR-116	X		X		X
72-MDR-117			X		X
72-MDR-118	X		X		
72-MDR-119	X		X		
72-MDR-120	X		X		
72-MDR-121	X		X		
72-MDR-122	X		X		
72-MDR-123	X		X		
72-MDR-124	X				
72-MDR-125	X				
72-MDR-126	X				
72-MDR-127	X				
72-MDR-131	X		X		
72-MDR-132	X		X		
72-MDR-133	X		X		
72-MDR-134	X		X		
72-MDR-135	X		X		

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-MDR-136	X		X		
72-MDR-137	X				
72-MDR-138	X				
72-MDR-139	X				
72-MDR-140	X				
72-MDR-141	X				
72-MDR-142	X				
72-MDR-143	X				
72-MDR-144	X		X		
72-MDR-145	X		X		
72-MDR-146	X		X		
72-MDR-146A	X		X		
72-MDR-147	X		X		
72-MDR-147A	X		X		
72-MDR-148	X		X		
72-MDR-149	X		X		
72-MDR-150	X				
72-MDR-151	X				
72-MDR-159	X		X		
72-MDR-162	X		X		
72-MDR-163	X	X			
72-MDR-164	X	X			
72-MDR-165	X	X			
72-MDR-166	X				
72-MDR-167	X				
72-MDR-168	X		X		
72-MDR-169	X		X		
72-MDR-170	X		X		
72-MDR-171	X				
72-MDR-172	X				
72-MDR-173	X		X		
72-MDR-174	X		X		
72-MDR-175	X		X		
72-MDR-176	X		X		
72-MSA-006	X		X		
72-MSA-007	X		X		
72-MSA-008					
72-MSA-009					
72-MSA-010	X		X		
72-MSA-011	X				

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-MSA-015	X		X		
72-MSA-016	X		X		
72-MSA-017	X		X		
72-MSA-018	X		X		
72-MSA-019		X	X		
72-MSA-020			X		
72-MSA-021			X		
72-MSA-022	X		X		
72-MSA-023			X		
72-MSA-024	X		X		
72-MSA-025	X		X		
72-MSA-026	X		X		
72-MSA-027	X		X		
72-MSA-028	X		X		
72-MSA-029	X		X		
72-MSA-030	X		X		
72-MSA-031	X		X		
72-MSA-032	X		X		
72-MSA-033	X		X		
72-MSA-034			X		
72-MSA-035			X		
72-MSA-036			X		
72-MSA-037			X		
72-MSA-038					X
72-MSA-039					X
72-MSA-040					X
72-MSA-041	X				X
72-MSA-042	X				X
72-MSA-043	X		X		
72-MSA-044	X		X		
72-MSA-045	X		X		
72-MSA-046			X		
72-MSA-047			X		
72-MSA-048	X		X		
72-MSA-049	X		X		
72-MSA-050	X		X		
72-MSA-051	X		X		
72-MSA-052	X		X		
72-MSA-053	X		X		
72-MSA-054	X		X		

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-MSA-055	X		X		
72-MSA-056	X		X		
72-MSA-057	X		X		
72-MSA-059	X		X		
72-MSA-060	X		X		
72-MSA-061	X	X	X		
72-MSA-062	X	X	X		
72-MSA-063	X	X	X		
72-MSA-064	X		X		
72-MSA-065	X		X		
72-MSA-066			X		
72-MSA-067			X		
72-MSA-068	X		X		X
72-MSA-069			X		X
72-MSA-070	X		X		
72-MSA-071	X		X		
72-MSA-072			X		
72-MSA-073	X				
72-MSA-074	X				
72-MSA-075	X		X		
72-MSA-076	X		X		
72-MSA-077	X		X		
72-MSA-078	X		X		
72-MSA-079	X		X		
72-MSA-080	X				
72-MSA-081	X				
72-MSA-083	X		X		
72-MSA-084	X		X		
72-MSA-085	X		X		
72-MSA-086	X		X		
72-MSA-087	X		X		
72-MSA-088	X		X		X
72-MSA-089	X		X		X
72-MSA-090	X		X		X
72-MSA-091	X		X		X
72-MSA-092	X		X		X
72-MSA-093	X		X		X
72-MSA-094	X		X		X
72-MSA-095	X		X		
72-MSA-096	X		X		

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS
FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-MSA-097	X		X		
72-MSA-098	X		X		
72-MSA-099	X		X		
72-MSA-100	X		X		
72-MSA-101	X		X		
72-MSA-102	X		X		
72-MSA-103	X		X		
72-MSA-104	X		X		
72-MSA-105	X		X		
72-MSA-106	X		X		
72-MSA-107	X		X		
72-MSA-108	X		X		
72-MSA-109			X		
72-MSA-110			X		
72-MSA-111	X		X		
72-MSA-112	X		X		
72-MSA-113	X		X		X
72-MSA-114	X		X		X
72-MSA-115	X		X		
72-MSA-116	X		X		
72-MSA-117	X		X		
72-MSA-118	X		X		
72-MSA-119	X		X		
72-MSA-120	X		X		
72-MSA-121	X		X		
72-MSA-122	X				
72-MSA-123	X				
72-MSA-124	X				
72-MSA-125	X				
72-MSA-128	X		X		
72-MSA-130	X		X		
72-MSA-131	X		X		
72-MSA-133	X		X		
72-MSA-134	X		X		
72-MSA-135	X				
72-MSA-136	X				
72-MSA-137	X				
72-MSA-138	X				
72-MSA-139	X				
72-MSA-140	X				

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-MSA-141	X				
72-MSA-142	X		X		
72-MSA-143	X		X		
72-MSA-144	X		X		
72-MSA-145	X				
72-MSA-146	X		X		
72-MSA-147	X		X		
72-MSA-153	X		X		
72-MSA-154	X				
72-MSA-156	X		X		
72-MSA-157	X		X		
72-MSA-158	X		X		
72-MSA-160	X		X		
72-MSA-161	X		X		
72-MSA-162	X		X		
72-MSA-162A	X		X		
72-MSA-163	X		X		
72-MSA-164	X		X		
72-MSA-165	X		X		
72-MSA-167	X				
72-MSA-168	X				
72-MSA-169	X				
72-MSA-170	X		X		
72-MSA-173			X		
72-MSA-174	X		X		
72-MSA-177	X	X	X		X
72-MSA-178	X	X	X		X
72-MSA-179	X	X	X		
72-MSA-180	X	X	X		
72-MSA-181	X		X	X	
72-MSA-182	X				
72-MSA-183	X		X		
72-MSA-183A	X		X		
72-MSA-184	X		X		
72-WQ1-001	X		X		
72-WQ1-002	X				
72-WQ1-003	X		X		
72-WQ1-004			X		
72-WQ1-005	X		X		
72-WQ1-006	X	X	X		

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-WQ1-007	X		X		
72-WQ1-008			X		
72-WQ1-009			X		X
72-WQ1-010			X		X
72-WQ1-011			X		
72-WQ1-012			X		
72-WQ1-013	X				
72-WQ1-015			X		
72-WQ1-016			X		
72-WQ1-017			X		
72-WQ1-019			X		
72-WQ1-020			X		
72-WQ2-001	X		X		
72-WQ2-002	X		X		
72-WQ2-003	X		X		
72-WQ2-004	X		X		
72-WQ2-005	X		X		
72-WQ2-006	X		X		
72-WQ2-007	X		X		
72-WQ2-008	X		X		
72-WQ2-009	X	X			
72-WQ2-010	X		X		
72-WQ2-011	X		X		
72-WQ2-012	X				X
72-WQ2-013	X		X		
72-WQ2-014			X		
72-WQ2-015			X		
72-WQ2-016	X				
72-WQ2-017	X		X		
72-WQ2-018			X		
72-WQ2-020			X		
72-WQ3-001	X		X		
72-WQ3-002	X		X		
72-WQ3-003	X		X		
72-WQ3-004	X		X		
72-WQ3-005	X		X		
72-WQ3-006			X		
72-WQ3-007	X		X		
72-WQ3-008	X		X		
72-WQ3-009	X	X	X		

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-WQ3-010	X		X		
72-WQ3-011			X		
72-WQ3-012			X		
72-WQ3-013	X		X		X
72-WQ3-014			X		
72-WQ3-015			X		
72-WQ3-017			X		
72-WQ3-018			X		
72-WQ3-020			X		
72-WQ4-001	X		X		
72-WQ4-002	X		X		
72-WQ4-003	X		X		X
72-WQ4-004	X		X		
72-WQ4-005	X		X		
72-WQ4-006	X		X		
72-WQ4-007	X		X		
72-WQ4-009	X		X		
72-WQ4-010	X	X	X		
72-WQ4-011	X		X		
72-WQ4-012			X		
72-WQ4-013			X		X
72-WQ4-014			X		
72-WQ4-015			X		
72-WQ4-017			X		
72-WQ4-018	X		X		
72-WQ4-020			X		
72-WQ5-001	X		X		X
72-WQ5-002	X		X		X
72-WQ5-003	X		X		X
72-WQ5-004	X		X		
72-WQ5-005	X		X		
72-WQ5-006	X		X		
72-WQ5-007	X		X		
72-WQ5-008	X		X		
72-WQ5-009	X		X		
72-WQ5-010	X	X	X		
72-WQ5-011	X	X	X		
72-WQ5-012			X		
72-WQ5-013			X		X
72-WQ5-014			X		

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-WQ5-015			X		
72-WQ5-017			X		
72-WQ5-018			X		
72-WQ5-020			X		
72-WQ6-001	X		X		
72-WQ6-002	X		X		
72-WQ6-003	X		X		
72-WQ6-004	X		X		
72-WQ6-006	X		X		
72-WQ6-007	X	X	X		
72-WQ6-008	X		X		
72-WQ6-009			X		
72-WQ6-010			X		
72-WQ6-011			X		
72-WQ6-012			X		
72-WQ6-013			X		
72-WQ6-015			X		
72-WQ6-017			X		
72-WQ6-019			X		
72-WQ7-001	X		X		X
72-WQ7-002	X		X		X
72-WQ7-003	X		X		X
72-WQ7-004	X		X		
72-WQ7-005	X		X		
72-WQ7-006	X		X		
72-WQ7-007	X		X		
72-WQ7-008			X		
72-WQ7-009	X		X		
72-WQ7-010	X	X	X		
72-WQ7-011	X		X		
72-WQ7-012			X		
72-WQ7-013			X		X
72-WQ7-014			X		
72-WQ7-015	X		X		
72-WQ7-016			X		
72-WQ7-017	X		X		
72-WQ7-018			X		
72-WQ7-020			X		
72-WQ8-001	X		X		X
72-WQ8-002	X		X		

TABLE 9-3

SUMMARY TABLE OF VALIDATION FINDINGS FOR SAMPLES ANALYZED FOR METALS

Sample Number	Blanks[a]	ICP Serial Dilution[b]	MS/MSD[c]	Internal Standards[d]	Continuing Calibration[e]
72-WQ8-003	X		X		
72-WQ8-004	X		X		
72-WQ8-005	X		X		
72-WQ8-006	X		X		
72-WQ8-008	X		X		
72-WQ8-009	X	X	X		
72-WQ8-010	X		X		
72-WQ8-011	X	X	X		
72-WQ8-012			X		
72-WQ8-013			X		X
72-WQ8-014			X		
72-WQ8-015	X		X		
72-WQ8-017	X		X		
72-WQ8-018			X		
72-WQ8-020			X		

Notes:

[a] Method blank contamination affected the checked samples. Sample concentrations either not detected or less than 5 times blank contaminant concentrations were flagged "U".

[b] ICP serial dilutions were outside of the QC limits for the checked samples. Therefore, these samples were flagged "J".

[c] %R or RPDs outside of the QC limits for checked samples. Therefore, these samples were flagged "J/UJ".

[d] %R outside of the QC limits for checked samples. Therefore, these samples were flagged "J/UJ".

[e] %D of continuing calibration did not meet the QC requirement for checked samples. Therefore, these samples were flagged "J/UJ".

Abbreviations and Acronyms:

%D – percent difference
%R – percent recovery
ICP – inductively coupled plasma
J – estimated value
MS – matrix spike
MSD – matrix spike duplicate
QC – quality control
RPD – relative percent difference
U – analyte not detected above project reporting limit

FIGURES

APPENDIX A

WEATHER DATA AND AIR MONITORING REPORT

(AVAILABLE ON CD ONLY)

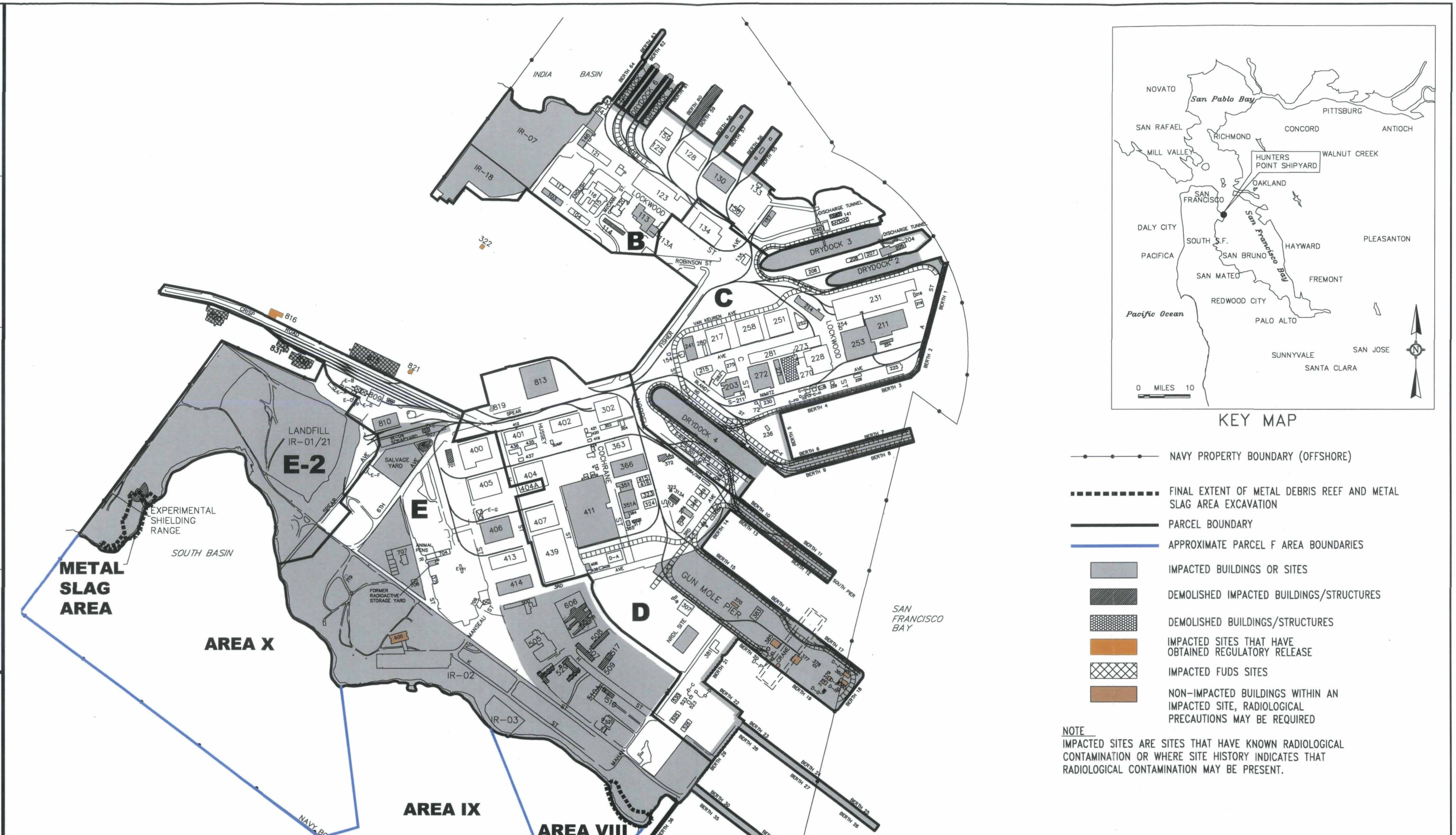


FIGURE 1-1
METAL DEBRIS REEF AND METAL SLAG AREA LOCATION MAP

HUNTERS POINT SHIPYARD-SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWN BY: KLD | DATE: 08/17/07 | CHECKED BY: BKM | REV: 0 | APPROVED BY: RA | DCN:ECSD-5713-0072-0004 | CTO: 0072 | DRAWING NO: 00720000411.DWG

I:\1990-RAC\CTO-0072\DWG\00720004\00720000411.DWG
PLOT/UPDATE: MAR 07 2007 14:52:22

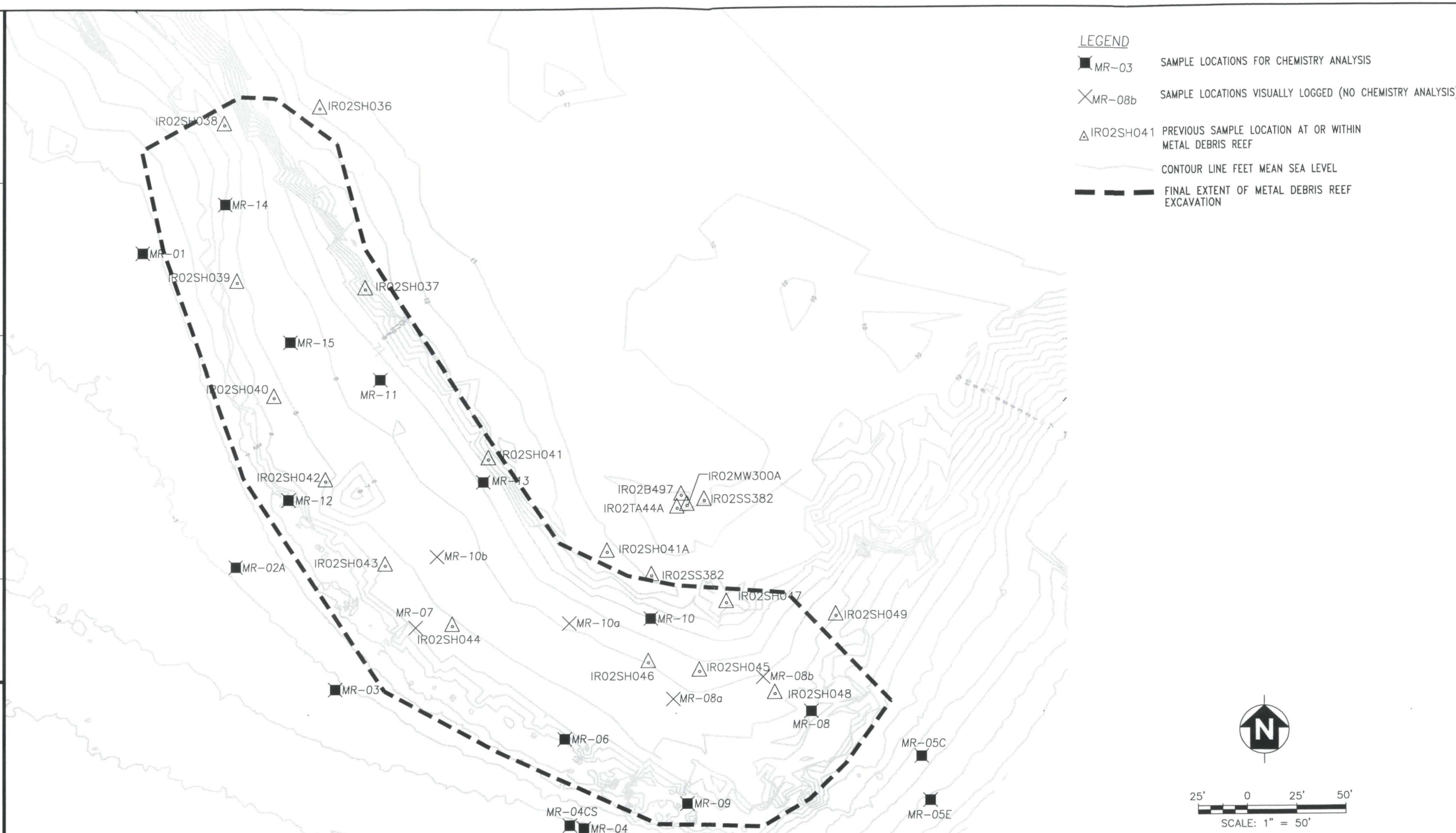


FIGURE 2-1
METAL DEBRIS REEF 2004 CHEMICAL CHARACTERIZATION SAMPLE LOCATIONS

HUNTERS POINT SHIPYARD–SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWN BY: KLD | DATE: 11/30/07
CHECKED BY: BKM | REV: 0
APPROVED BY: RA
DCN:ECSD-5713-0072-0004 | CTO: 0072
DRAWING NO: 0072000421.DWG

:\1990-RAC\CTO-0072\DWG\00720004\0072000421.DWG
PLOT/UPDATE: MAR 18 2007 15:04:52

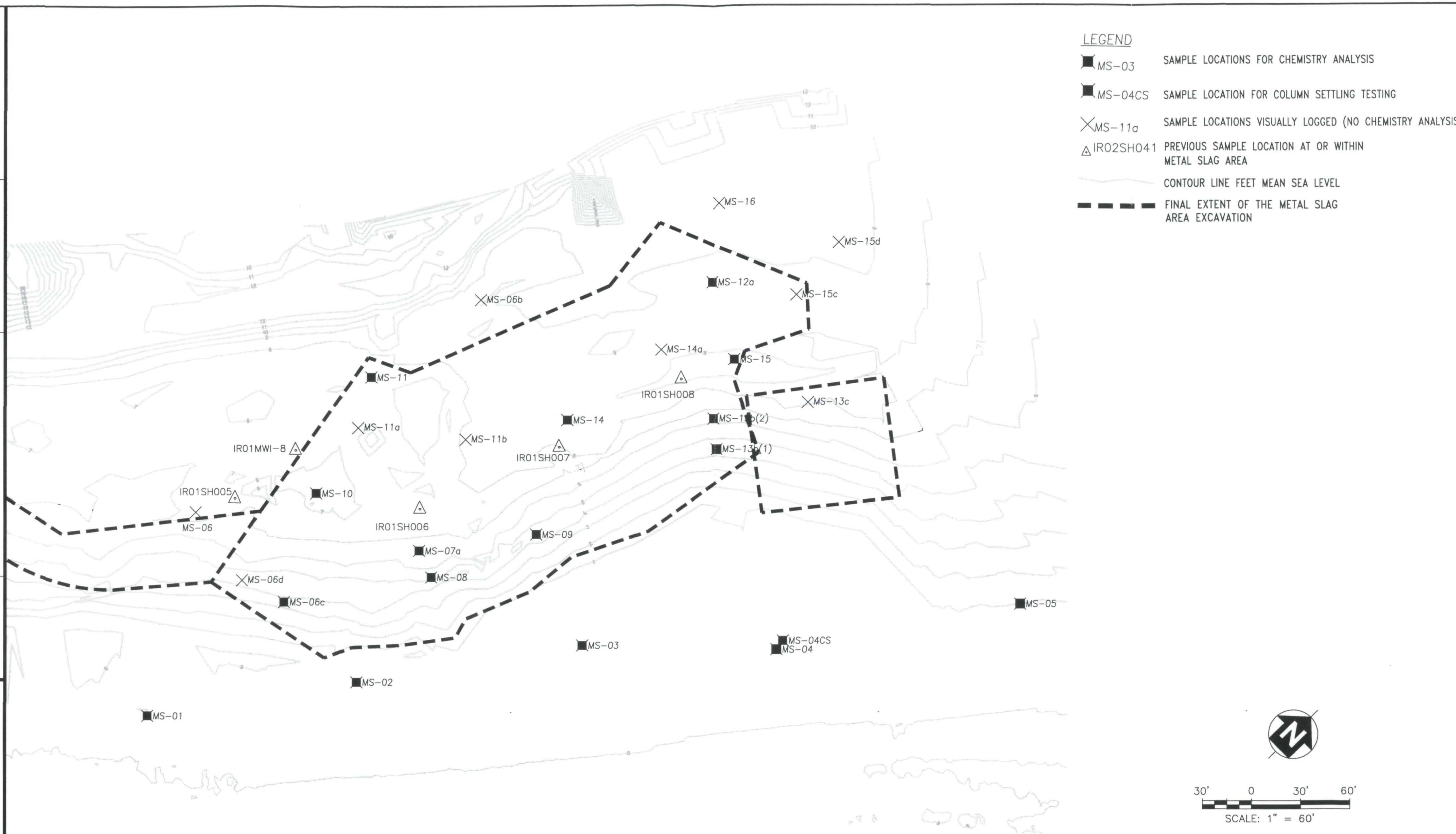


FIGURE 2-2
METAL SLAG AREA 2004 CHEMICAL CHARACTERIZATION SAMPLE LOCATIONS

HUNTERS POINT SHIPYARD–SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWING NO: 0072000422.DWG

DCN: ECSD-5713-0072-0004 CTO: 0072

APPROVED BY: RA

CHECKED BY: BKM REV: 0

DRAWN BY: KLD DATE: 11/30/07

:\1990-RAC\CTO-0072\DWG\00720004\0072000422.DWG
PLOT/UPDATE: MAY 18 2005 15:17:45

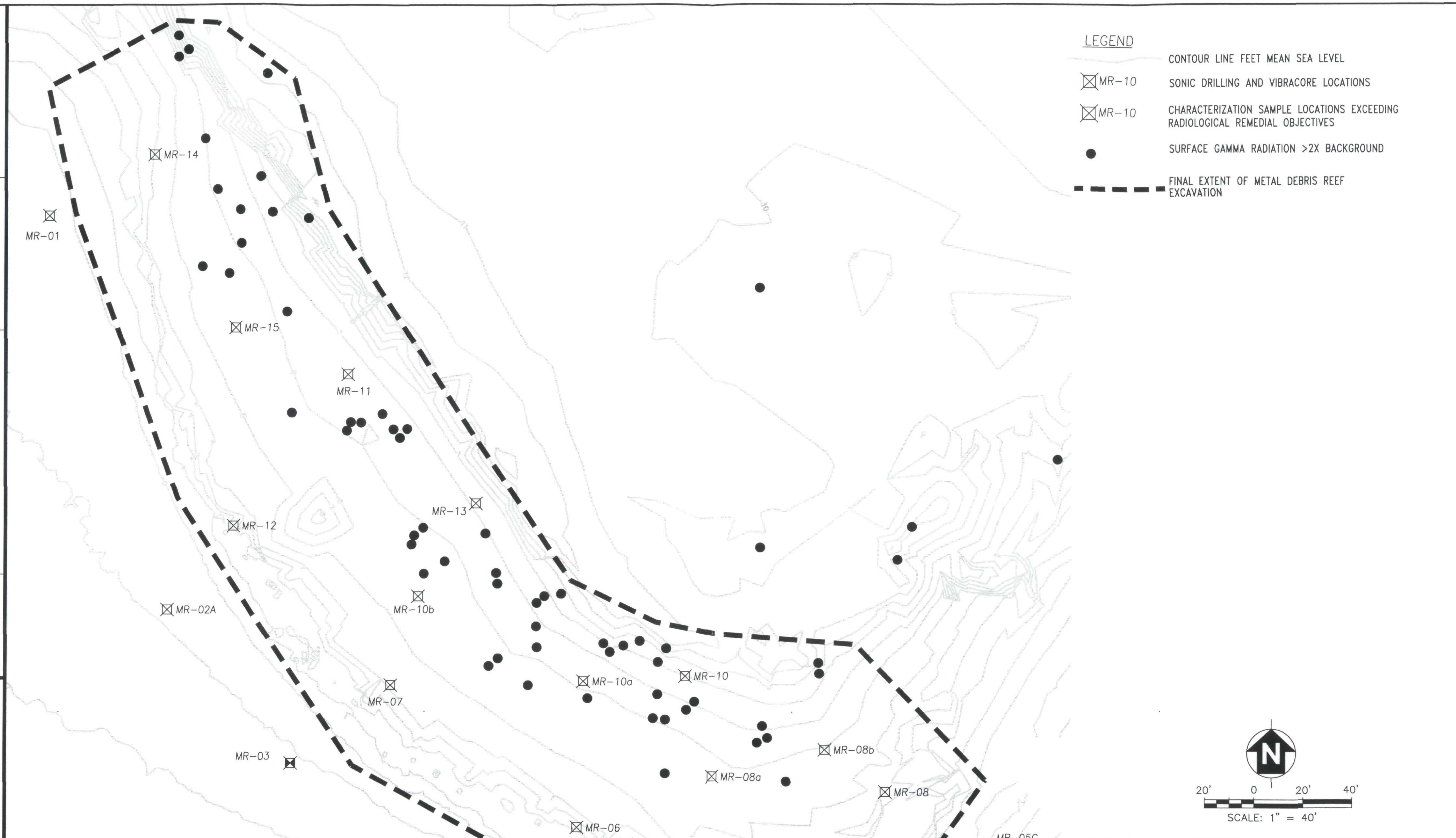


FIGURE 2-3
METAL SLAG AREA 2004 CHEMICAL CHARACTERIZATION SAMPLE LOCATIONS

HUNTERS POINT SHIPYARD–SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWING NO: 0072000423.DWG

DCN: ECSD-5713-0072-0004

CTO: 0072

APPROVED BY: RA

CHECKED BY: BKM

REV: 0

DRAWN BY: KLD

DATE: 11/30/07

:\1990-RAC\CTO-0072\DWG\00720004\0072000423.DWG
PLOT/UPDATE: MAY 18 2005 15:17:45

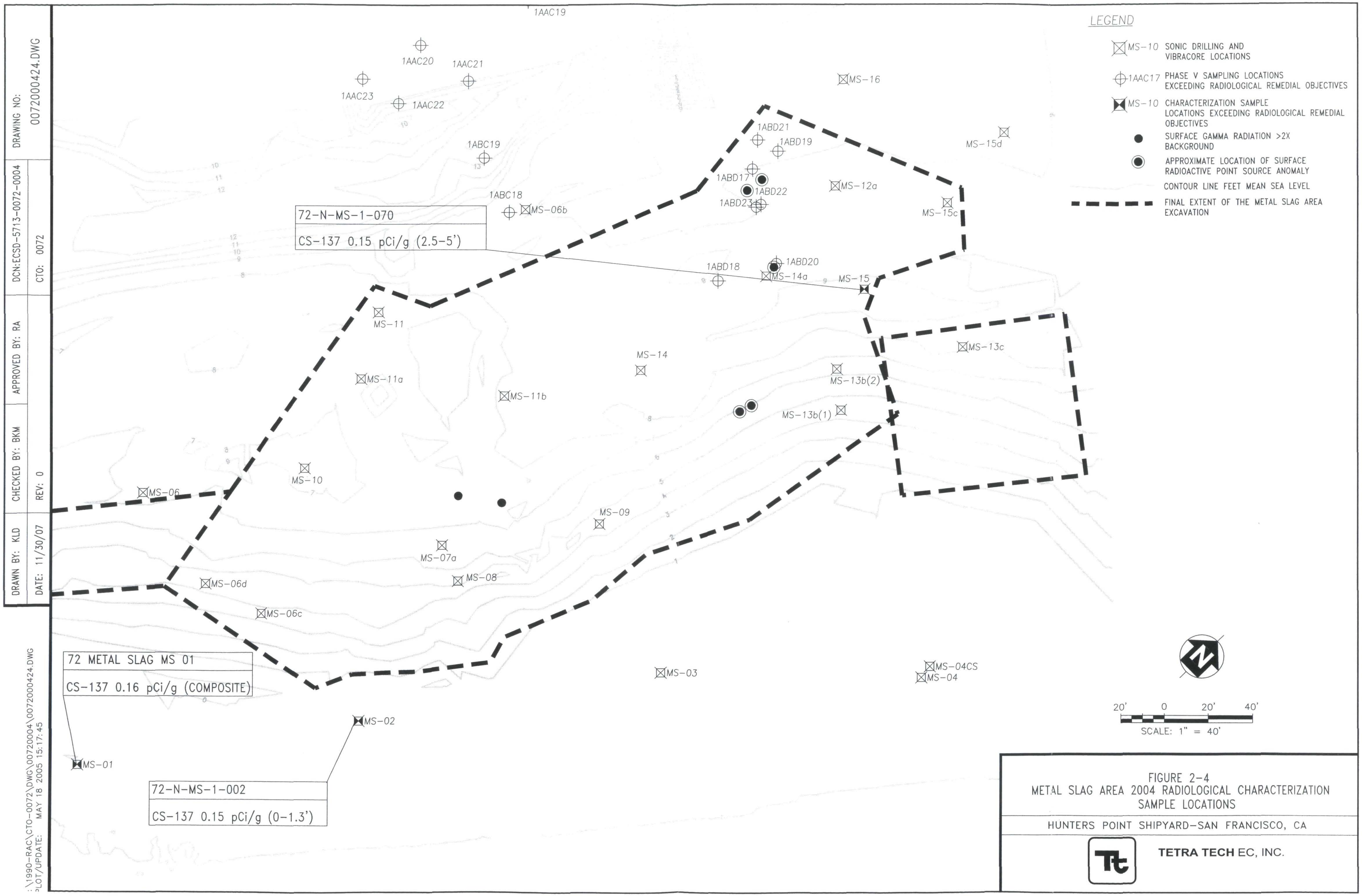


FIGURE 2-4
METAL SLAG AREA 2004 RADIOLOGICAL CHARACTERIZATION SAMPLE LOCATIONS

HUNTERS POINT SHIPYARD-SAN FRANCISCO, CA

TETRA TECH EC, INC.

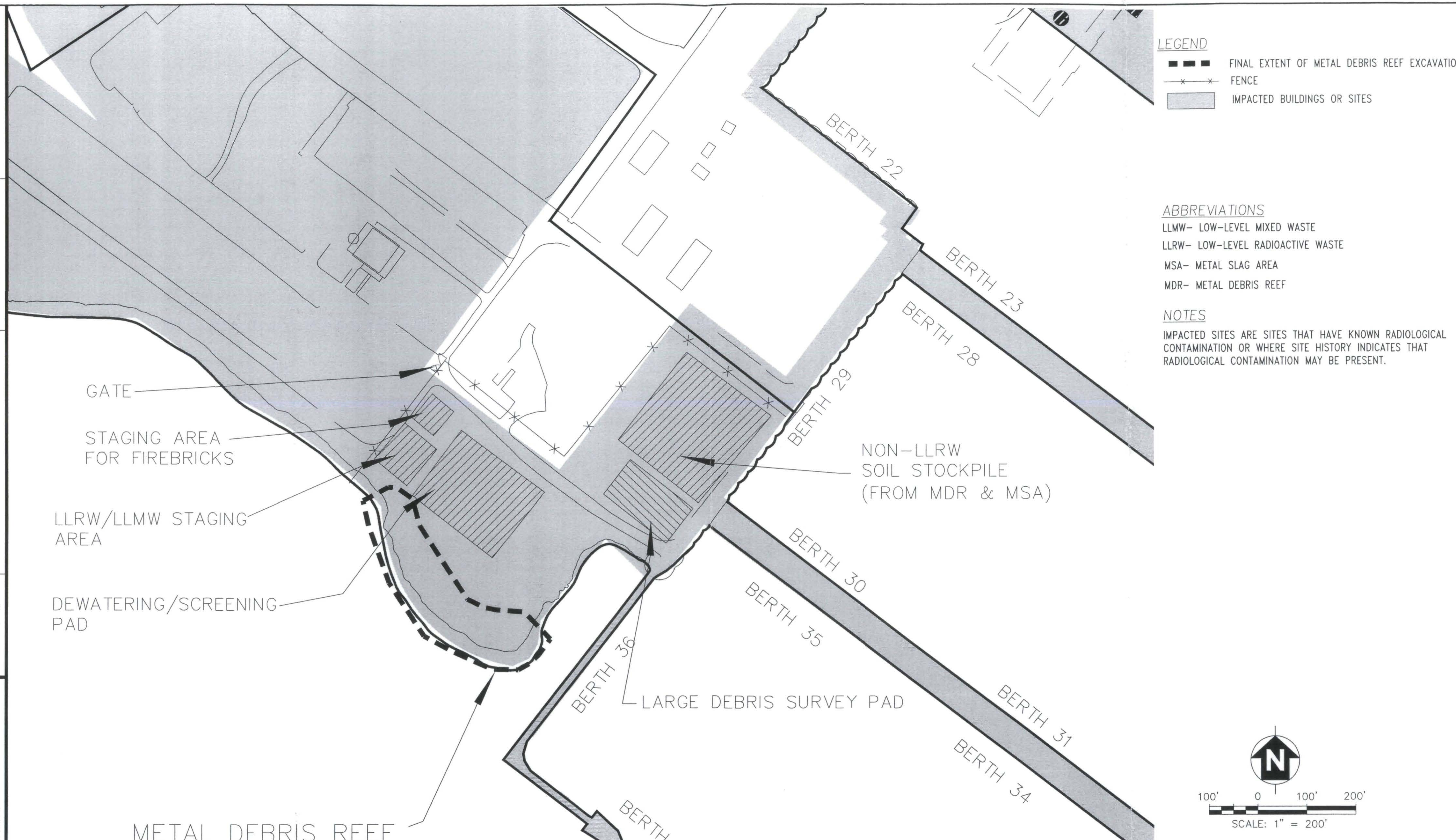


FIGURE 3-1
METAL DEBRIS REEF SITE LAYOUT

HUNTERS POINT SHIPYARD–SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWN BY: KLD | DATE: 11/30/07 | CHECKED BY: BKM | REV: 0 | APPROVED BY: RA | DCN: ECSD-5713-0072-0004 | CTO: 0072 | DRAWING NO: 0072000431.DWG

:\1990-RAC\CTO-0072\DWG\00720004\0072000431.DWG
PLOT/UPDATE: MAY 19 2005 15:08:49

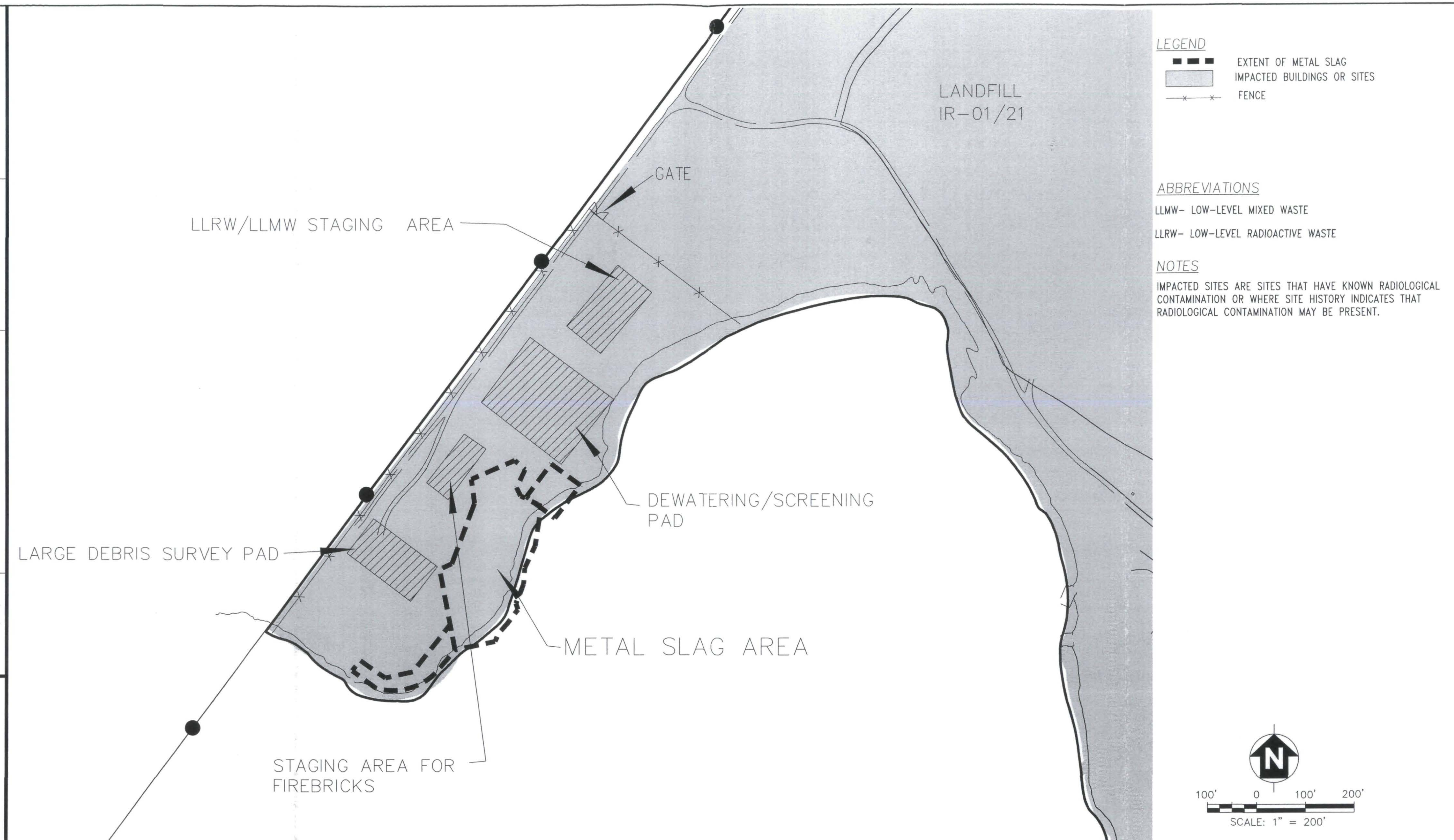


FIGURE 3-2
METAL SLAG AREA SITE LAYOUT

HUNTERS POINT SHIPYARD–SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWN BY: KLD | CHECKED BY: BKM | APPROVED BY: RA | DCN: ECSD-5713-0072-0004 | DRAWING NO: 0072000432.DWG

DATE: 11/30/07 | REV: 0 | CTO: 0072

:\1990-RAC\CTO-0072\DWG\00720004\0072000432.DWG
PLOT/UPDATE: MAR 18 200715:49:30

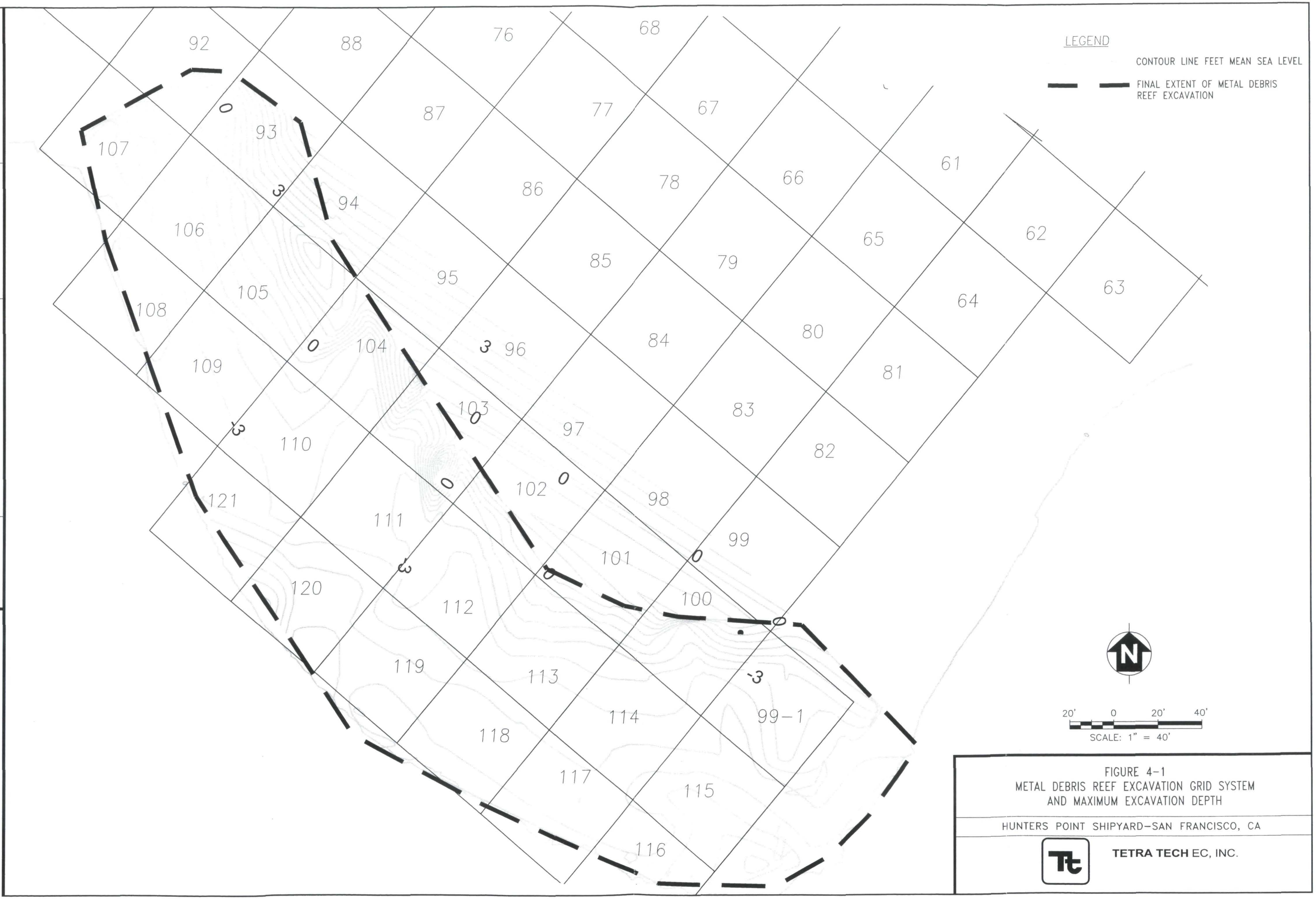


FIGURE 4-1
METAL DEBRIS REEF EXCAVATION GRID SYSTEM AND MAXIMUM EXCAVATION DEPTH

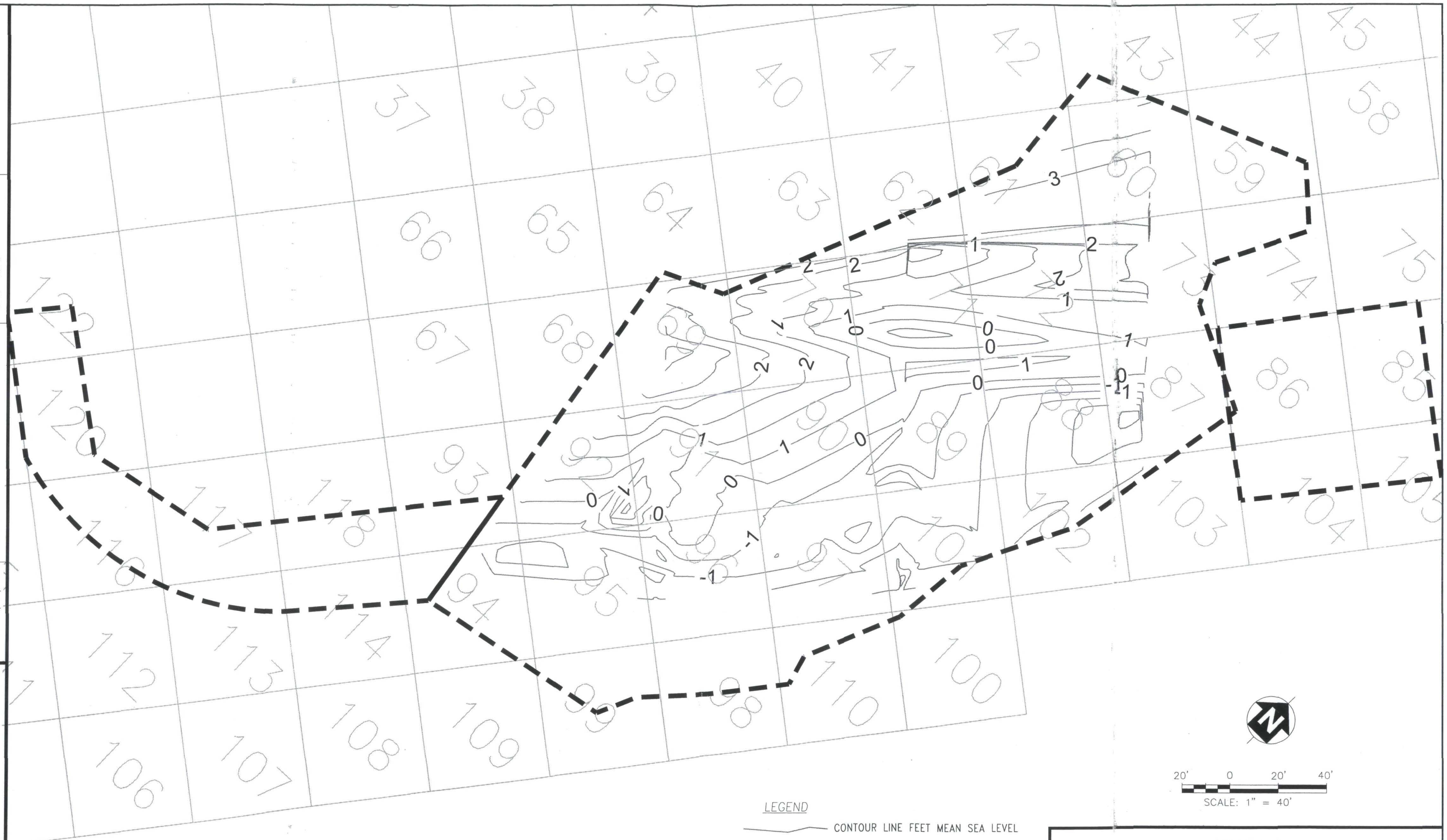
HUNTERS POINT SHIPYARD-SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWN BY: KLD | CHECKED BY: BKM | APPROVED BY: RA | DCN:ECSD-5713-0072-0004 | DRAWING NO: 0072000441.DWG

DATE: 11/30/07 | REV: 0 | CTO: 0072

:\1990-RAC\CTO-0072\DWG\00720004\0072000441.DWG
PLOT/UPDATE: MAR 18 2007 15:04:52



LEGEND

CONTOUR LINE FEET MEAN SEA LEVEL

FINAL EXTENT OF METAL SLAG AREA EXCAVATION

FIGURE 4-2
METAL SLAG AREA EXCAVATION GRID SYSTEM
AND MAXIMUM EXCAVATION DEPTH

HUNTERS POINT SHIPYARD–SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWING NO: 0072000442.DWG

DCN: ECSD-5713-0072-0004 | CTO: 0072

APPROVED BY: RA

CHECKED BY: BKM | REV: 0

DRAWN BY: KLD | DATE: 11/30/07

:\1990-RAC\CTO-0072\DWG\00720004\0072000442.DWG
PLOT/UPDATE: MAY 18 2005 15:17:45

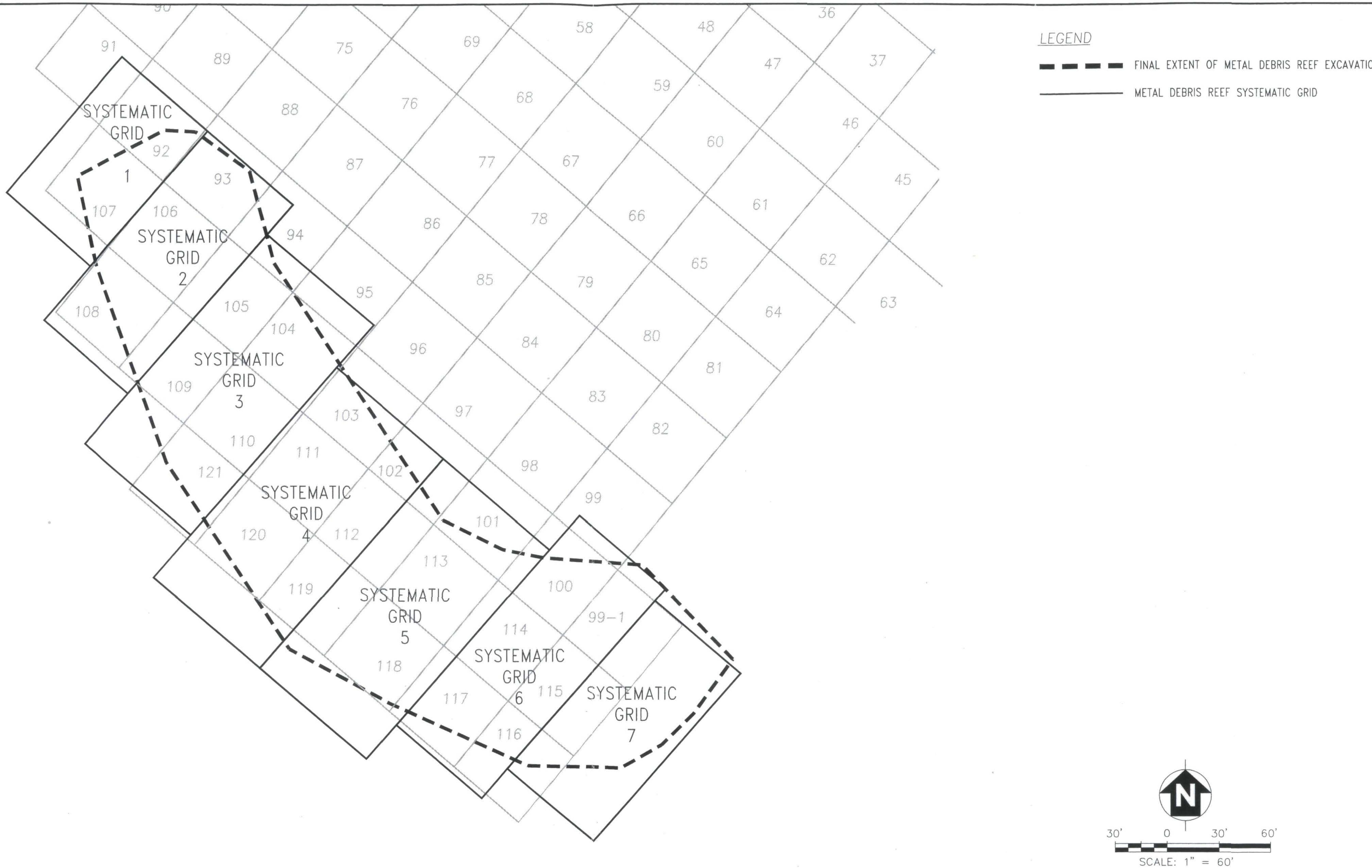


FIGURE 4-3
METAL DEBRIS REEF
RADIOLOGICAL SYSTEMATIC GRIDS

HUNTERS POINT SHIPYARD–SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWING NO: 00720000443.DWG
DCN: ECSD-5713-0072-0004
CTO: 0072
APPROVED BY: RA
CHECKED BY: BKM
REV: 0
DRAWN BY: KLD
DATE: 11/30/07

:\1990-RAC\CTO-0072\DWG\00720004\00720043.DWG
PLOT/UPDATE: MAR 18 2007 15:49:30

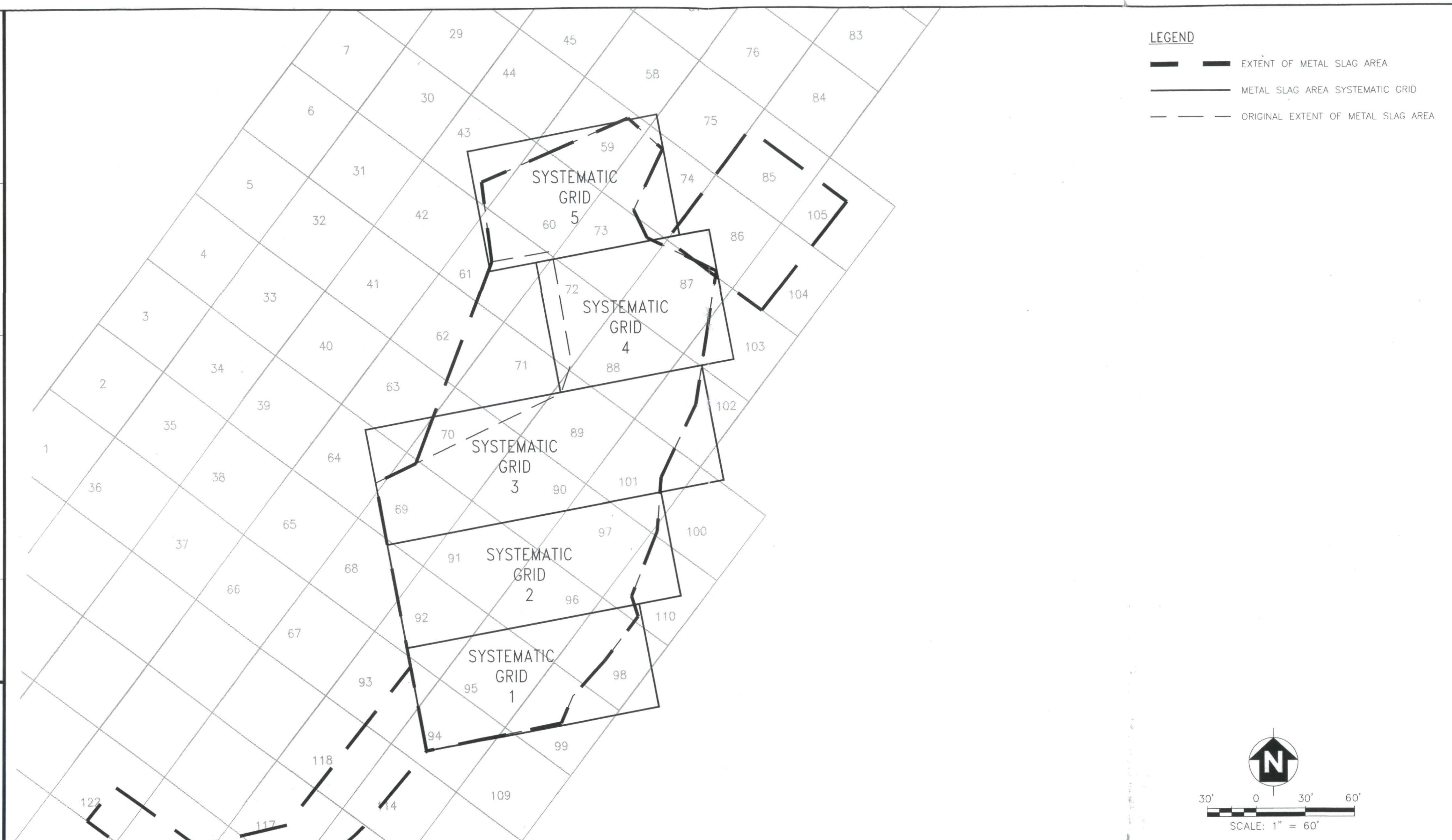


FIGURE 4-4
RADIOLOGICAL SYSTEMATIC GRIDS
AT METAL SLAG AREA

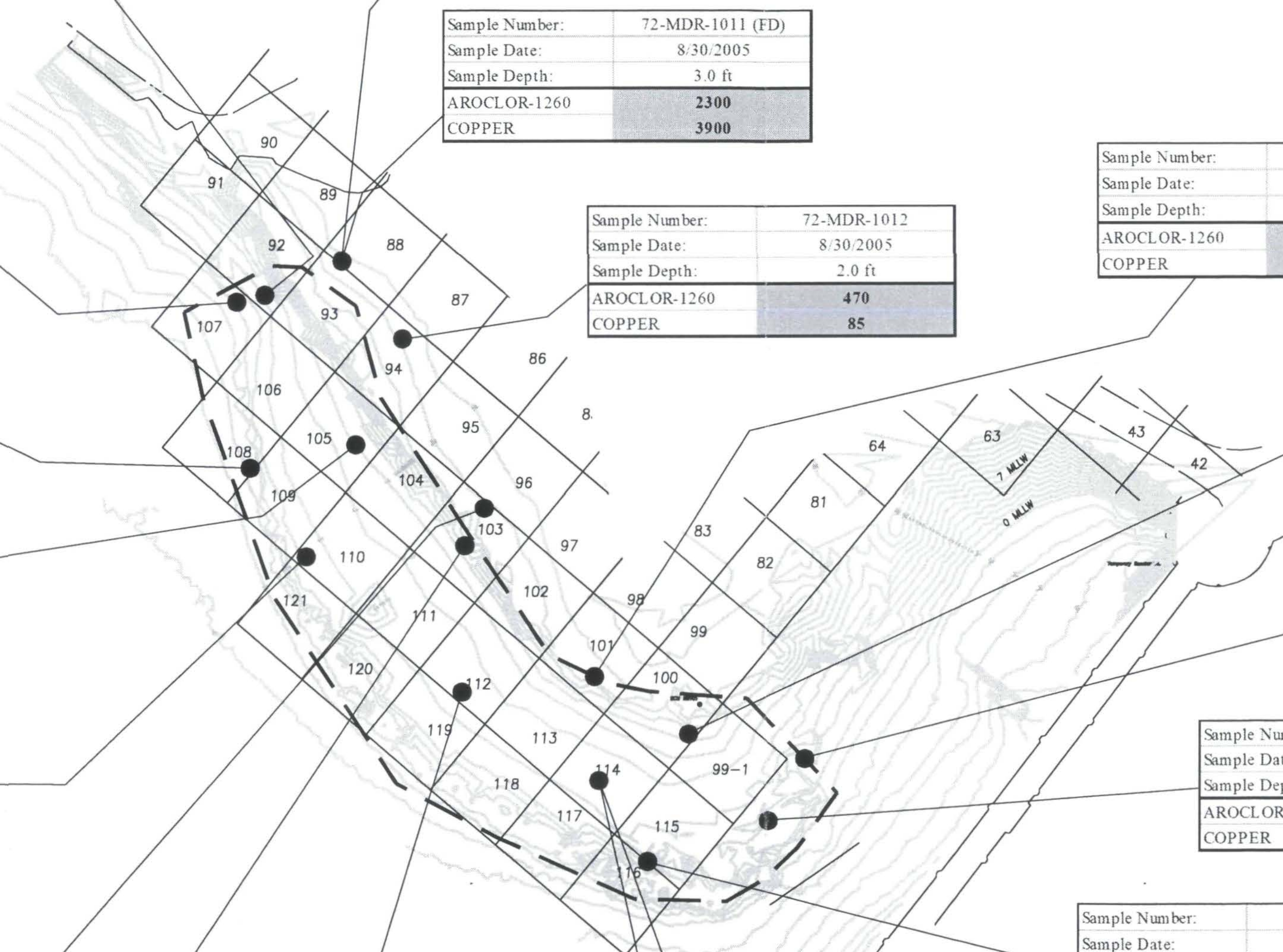
HUNTERS POINT SHIPYARD–SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWN BY: KLD | DATE: 11/30/07 | CHECKED BY: BKM | REV: 0 | APPROVED BY: RA | DCN: ECSD-5713-0072-0004 | CTO: 0072 | DRAWING NO: 00720000444.DWG

:\1990-RAC\CTO-0072\DWG\00720004\00720004244.DWG
PLOT/UPDATE: MAR 18 200715:49:30

DRAWN BY: KLD | DATE: 11/30/07 | CHECKED BY: BKM | REV: 0 | APPROVED BY: RA | DCN: ECSD-5713-0072-0004 | CTO: 0072 | DRAWING NO: 0072000445.DWG



Sample Number:	72-MDR-1000
Sample Date:	7/11/2005
Sample Depth:	1.5 ft
AROCLOR-1260	66
COPPER	26

Sample Number:	72-MDR-1010
Sample Date:	8/30/2005
Sample Depth:	3.0 ft
AROCLOR-1260	1700 J
COPPER	3300

Sample Number:	72-MDR-1001
Sample Date:	7/18/2005
Sample Depth:	2.0 ft
AROCLOR-1260	14
COPPER	11 J

Sample Number:	72-MDR-1011 (FD)
Sample Date:	8/30/2005
Sample Depth:	3.0 ft
AROCLOR-1260	2300
COPPER	3900

Sample Number:	72-MDR-1021
Sample Date:	9/18/2005
Sample Depth:	0.0 ft
AROCLOR-1260	130
COPPER	600

Sample Number:	72-MDR-1012
Sample Date:	8/30/2005
Sample Depth:	2.0 ft
AROCLOR-1260	470
COPPER	85

Sample Number:	72-MDR-1003
Sample Date:	7/21/2005
Sample Depth:	2.5 ft
AROCLOR-1260	32 J
COPPER	27 J

Sample Number:	72-MDR-1023
Sample Date:	9/21/2005
Sample Depth:	1.5 ft
AROCLOR-1260	130
COPPER	360

Sample Number:	72-MDR-1014A
Sample Date:	9/15/2005
Sample Depth:	1.0 ft
AROCLOR-1260	5100
COPPER	56

Sample Number:	72-MDR-1022
Sample Date:	9/18/2005
Sample Depth:	1.0 ft
AROCLOR-1260	9.9 J
COPPER	60

Sample Number:	72-MDR-1002
Sample Date:	7/21/2005
Sample Depth:	3.0 ft
AROCLOR-1260	17 J
COPPER	24 J

Sample Number:	72-MDR-1019
Sample Date:	9/17/2005
Sample Depth:	3.0 ft
AROCLOR-1260	750
COPPER	3800

Sample Number:	72-MDR-1013
Sample Date:	8/30/2005
Sample Depth:	4.0 ft
AROCLOR-1260	260 J
COPPER	210

Sample Number:	72-MDR-1020
Sample Date:	9/17/2005
Sample Depth:	4.0 ft
AROCLOR-1260	170 J
COPPER	140

Sample Number:	72-MDR-1017 (FD)
Sample Date:	9/17/2005
Sample Depth:	2.5 ft
AROCLOR-1260	180
COPPER	160

Sample Number:	72-MDR-1018
Sample Date:	9/17/2005
Sample Depth:	3.0 ft
AROCLOR-1260	61
COPPER	22

Sample Number:	72-MDR-1015
Sample Date:	9/15/2005
Sample Depth:	0.0 ft
AROCLOR-1260	1300
COPPER	370

Sample Number:	72-MDR-1016
Sample Date:	9/17/2005
Sample Depth:	2.5 ft
AROCLOR-1260	280 J
COPPER	340

FIGURE 4-5
METAL DEBRIS REEF CHEMICAL POST EXCAVATION SAMPLING RESULTS

HUNTERS POINT SHIPYARD–SAN FRANCISCO, CA

TETRA TECH EC INC.

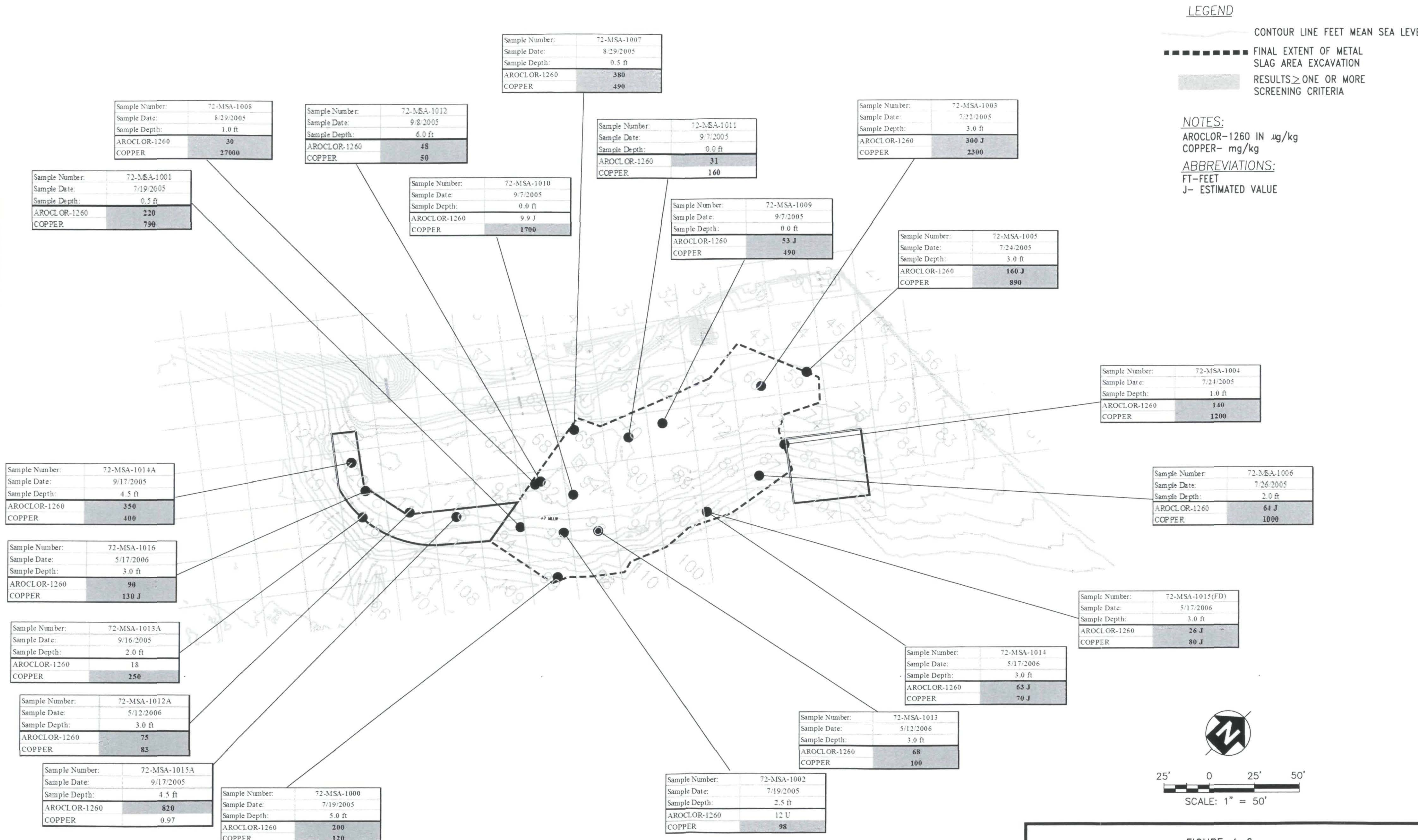
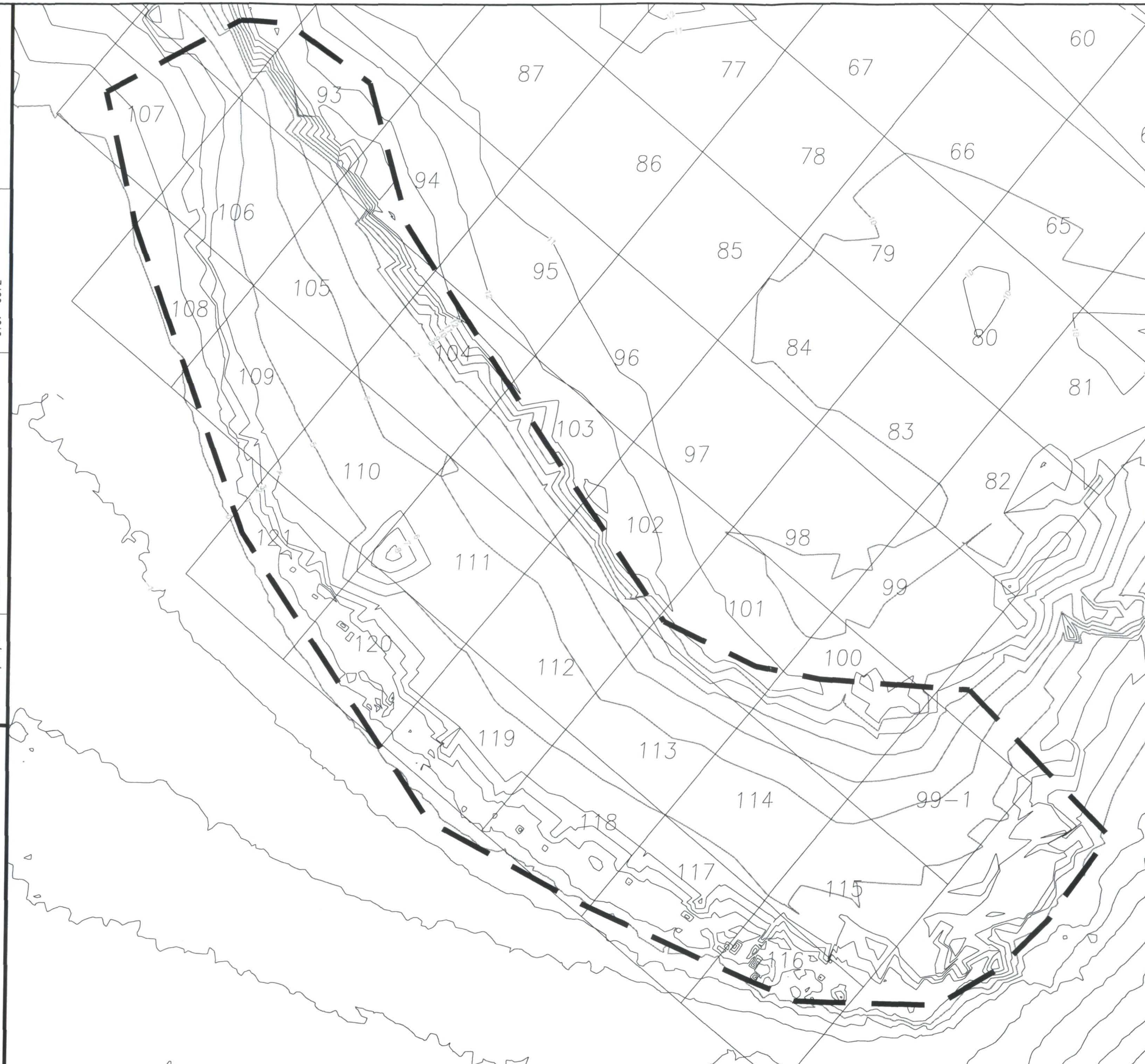


FIGURE 4-6
METAL SLAG AREA CHEMICAL POST-EXCAVATION SAMPLING RESULTS

HUNTERS POINT SHIPYARD-SAN FRANCISCO, CA

TETRA TECH EC INC.

DRAWN BY: KLD | DATE: 11/30/07 | CHECKED BY: BKM | REV: 0 | APPROVED BY: RA | DCN: ECSD-5713-0072-0004 | CTO: 0072 | DRAWING NO: 0072000446.DWG



LEGEND

CONTOUR LINE FEET MEAN SEA LEVEL

FINAL EXTENT OF METAL DEBRIS REEF EXCAVATION

N

20' 0 20' 40'

SCALE: 1" = 40'

FIGURE 5-1
METAL DEBRIS REEF PRE-CONSTRUCTION TOPOGRAPHIC CONTOUR MAP

HUNTERS POINT SHIPYARD–SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWN BY: KLD | DATE: 11/30/07 | CHECKED BY: BKM | REV: 0 | APPROVED BY: RA | DCN: ECSD-5713-0072-0004 | CTO: 0072 | DRAWING NO: 0072000451.DWG

:\1990-RAC\CTO-0072\DWG\00720004\0072000451.DWG
PLOT/UPDATE: MAR 18 2007 15:49:30

LEGEND

CONTOUR LINE FEET MEAN SEA LEVEL

FINAL EXTENT OF METAL SLAG AREA EXCAVATION

FIGURE 5-2
METAL SLAG AREA PRE-CONSTRUCTION TOPOGRAPHIC CONTOUR MAP

HUNTERS POINT SHIPYARD–SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWN BY: KLD
DATE: 11/30/07
CHECKED BY: BKM
REV: 0
APPROVED BY: RA
DCN: ECSD-5713-0072-0004
CTO: 0072
DRAWING NO: 0072000452.DWG

:\1990-RAC\CTO-0072\DWG\00720004\0072000452.DWG
PLOT/UPDATE: MAY 18 2005 15:17:45

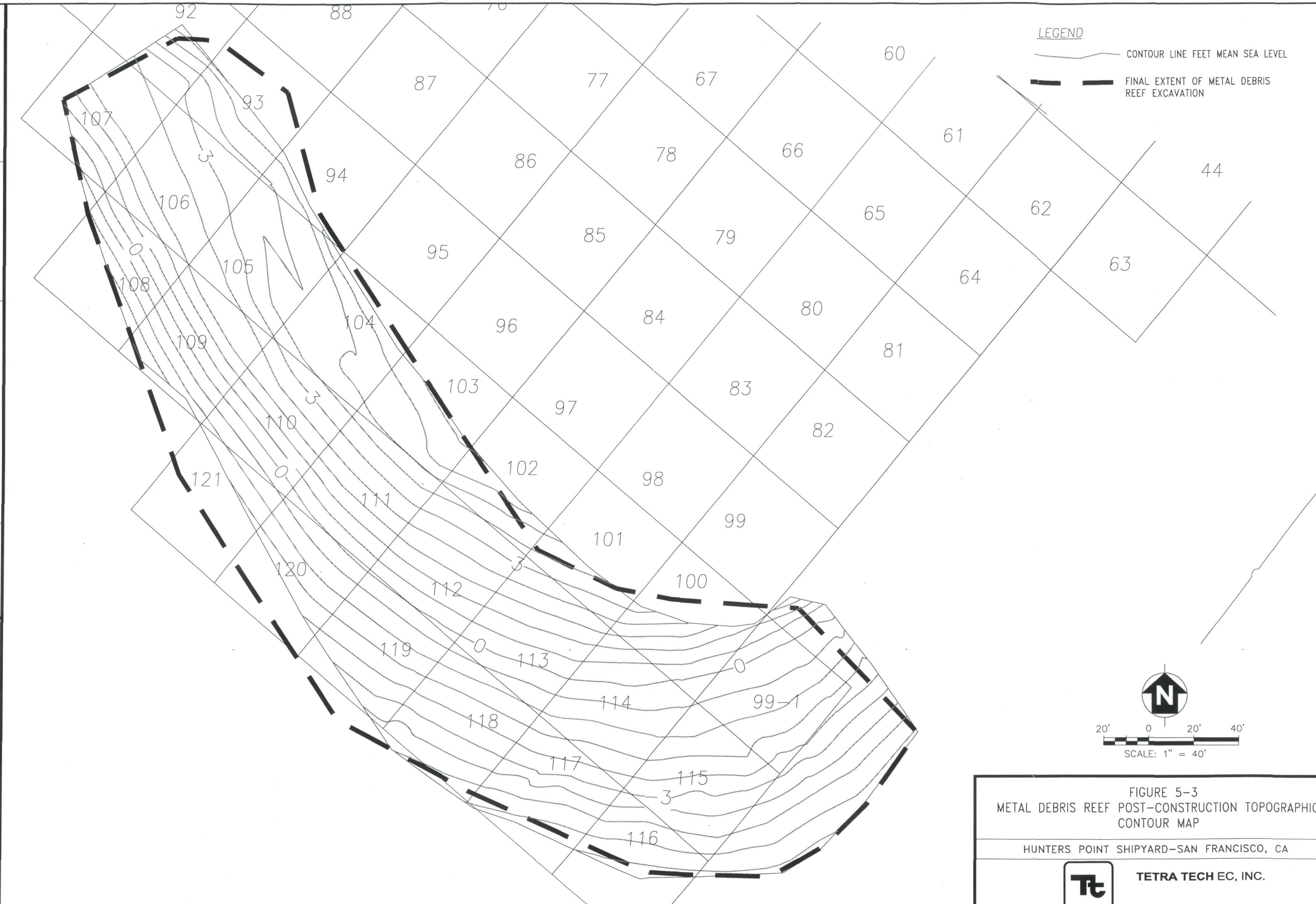


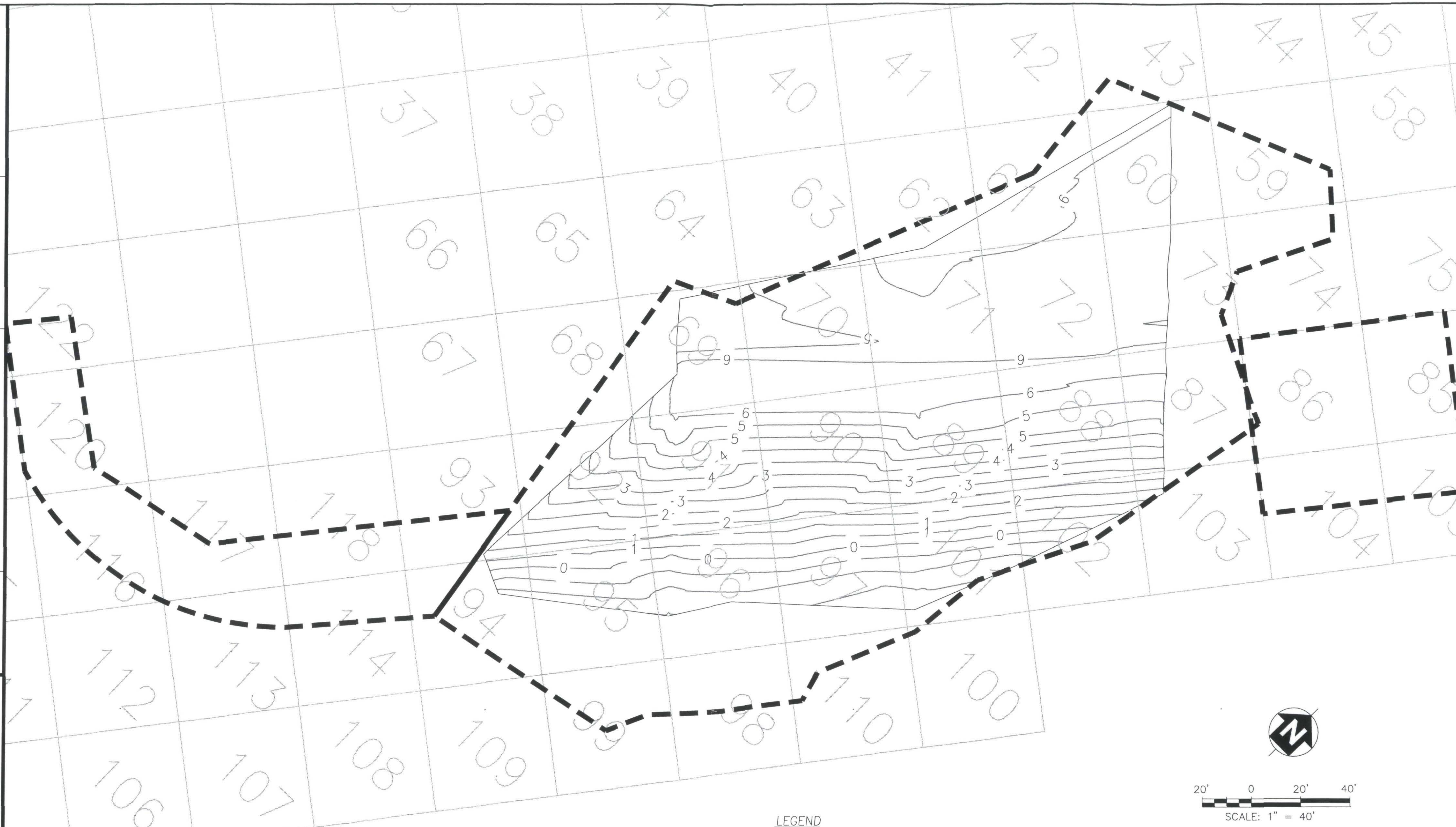
FIGURE 5-3
METAL DEBRIS REEF POST-CONSTRUCTION TOPOGRAPHIC CONTOUR MAP

HUNTERS POINT SHIPYARD-SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWING NO: 0072000453.DWG
DCN: ECSD-5713-0072-0004
CTO: 0072
APPROVED BY: RA
CHECKED BY: BKM
REV: 0
DRAWN BY: KLD
DATE: 11/30/07

:\1990-RAC\CTO-0072\DWG\00720004\007200053.DWG
PLOT/UPDATE: MAR 18 200715:49:30



LEGEND

CONTOUR LINE FEET MEAN SEA LEVEL

FINAL EXTENT OF METAL SLAG AREA EXCAVATION

FIGURE 5-4
METAL SLAG AREA POST-CONSTRUCTION TOPOGRAPHIC CONTOUR MAP

HUNTERS POINT SHIPYARD-SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWN BY: KLD | DATE: 11/30/07 | CHECKED BY: BKM | REV: 0 | APPROVED BY: RA | DCN: ECSD-5713-0072-0004 | CTO: 0072 | DRAWING NO: 0072000454.DWG

:\1990-RAC\CTO-0072\DWG\00720004\0072000454.DWG
PLOT/UPDATE: MAY 18 2005 15:17:45

APPENDIX A

WEATHER DATA AND AIR MONITORING REPORT

(AVAILABLE ON CD ONLY)

APPENDIX B

KICK-OFF MEETING AGENDA

(AVAILABLE ON CD ONLY)

APPENDIX C

WELL DESTRUCTION FORMS

(AVAILABLE ON CD ONLY)

APPENDIX D

POST-EXCAVATION CHEMICAL SAMPLING RESULTS FOR METAL DEBRIS REEF AND METAL SLAG AREA

(AVAILABLE ON CD ONLY)

APPENDIX E

BACKFILL MATERIAL REVIEW AND ACCEPTANCE DOCUMENTATION

(AVAILABLE ON CD ONLY)

APPENDIX F

WASTE DATA AND WASTE MANIFESTS

(AVAILABLE ON CD ONLY)

APPENDIX G

WATER QUALITY MONITORING SAMPLING RESULTS

(AVAILABLE ON CD ONLY)

APPENDIX H

SURVEY REPORTS

(AVAILABLE ON CD ONLY)

APPENDIX I

PROJECT PHOTOGRAPHS

(AVAILABLE ON CD ONLY)

APPENDIX J

FIELD CHANGE REQUEST (FCR) LOG AND FCRs

(AVAILABLE ON CD ONLY)

APPENDIX K

COMMUNITY RELATIONS DOCUMENTS

(AVAILABLE ON CD ONLY)

APPENDIX L

VALIDATED ANALYTICAL DATA PACKAGES

(AVAILABLE ON CD ONLY)

APPENDIX M

ON-SITE LABORATORY SYSTEMATIC SAMPLE RESULTS

(AVAILABLE ON CD ONLY)

APPENDIX N

OFFSITE LABORATORY SAMPLE REPORTS

(AVAILABLE ON CD ONLY)

APPENDIX O

RESPONSE TO COMMENTS

(AVAILABLE ON CD ONLY)

DEPARTMENT OF THE NAVY
BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
1455 FRAZEE RD, SUITE 900
SAN DIEGO, CA 92108-4310

5090
Ser BPMOW.sak/0132
NOV 3 0 2007

Mr. Mark Ripperda (SFD 8-3)
U.S. EPA
75 Hawthorne Street
San Francisco, CA 94105

Mr. Tom Lanphar
Department of Toxic Substances Control
700 Heinz Avenue, Bldg. F, Suite 200
Berkeley, CA 94710

Mr. Erich Simon
California Regional Water Quality Control Board, San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

Dear BCT Members:

Enclosed is the Final Removal Action Completion Report, Metal Debris Reef and Metal Slag Area Excavation Sites, Parcels E and E-2, at Hunters Point Shipyard, San Francisco, California, dated November 30, 2007. Thank you for your comments on this report. The Final Response to Comments document is included as Appendix O.

If you have questions, please contact Sarah Penn at (619) 532-0962.

Sincerely,

KEITH FORMAN
BRAC Environmental Coordinator
By direction of the Director

Enclosure: 1. Final Removal Action Completion Report, Metal Debris Reef and Metal Slag Area Excavation Sites, Parcels E and E-2, at Hunters Point Shipyard, San Francisco, California, dated November 30, 2007

5090
Ser BPMOW.sak/0132
NOV 3 0 2007

Copy to: (Hard Copy and CD)
Ms. Vandana Kohli
Department of Health Services
601 N. 7th Street, Mail Stop 396
PO Box 942732
Sacramento, CA 92434-7320

Mr. Patrick Shea
City of San Francisco – Public Library
100 Larkin Street
Government Information Center
5th Floor
San Francisco, CA 94102

Anna E. Waden Library
City of San Francisco – Public Library
5075 Third Street
San Francisco, CA 94124

Mr. Peter Stroganoff
ROICC San Francisco Bay Area,
Engineering Field Activity West
2450 Saratoga Street, Suite 200
Alameda, CA 94501-7545

Mr. Mike Mentink
Department of Navy
Public Affairs Office
410 Palm Avenue, Building One
Code 00PA
San Francisco, CA 94130

Mr. Leon Muhammad
5048 Third Street
San Francisco, CA 94124

Mr. Matthew Slack
Radiological Affairs Support Office
Building 1971,NWS P.O. Drawer 260
Yorktown, VA 23691-0260

Mr. Steve Hall
Tetra Tech EMI
1230 Columbia Street
Suite 1000
San Diego, CA 92101

Ms. Laurie Lowman
Radiological Affairs Support Office
Building 1971
NWS P.O. Drawer 260
Yorktown, VA 23691-0260

Ms. Karla Brasaemle
U.S. EPA Contractor, Tech Law, Inc.
90 New Montgomery Street, Suite 1010
San Francisco, CA 94105

Ms. Diane Silva (3 Hard Copies + 1 CD)
Records Manager (EVR.DS)
937 Harbor Drive
FISC Bldg 1 3rd Floor Room 71
San Diego, CA 92132

Mr. Michael Jacobvitz
5341 Old Redwood Highway
Suite 300
Petaluma, CA 94954

Ms. Dorinda Shipman
555 Montgomery Street
Suite 1300
San Francisco, CA 94111

Ms. Barbara Bushnell
6 Vistaview Court
San Francisco, CA 94124

5090
Ser BPMOW.sak/0132
NOV 3 0 2007

Copy to: (CD Only)
Ms. Amy Brownell
City of San Francisco
Department of Public Health
1390 Market Street, Suite 910
San Francisco, CA 94102

Mr. Michael Sharpless
55 2nd Street
24th Floor
San Francisco, CA 94104

Mr. Jeff Austin
49 Stevenson Street
Suite 525
San Francisco, CA 94105

Dr. Peter T. Palmer
1600 Holloway Ave., TH 730
San Francisco 94132

Mr. Gregg Grist
Tech Physics
1658 27th Ave.
San Francisco, CA 94122

Mr. Michael McGowan
4634 3rd Street
San Francisco, CA 94124

Ms. Rona Sandler
City Hall, Room 234
1 Dr Carlton B Goodlett Place
San Francisco, CA 94102

Mr. Robert Cotter
P.O. Box 0915
San Francisco, CA 94143

Mr. David Belk
50 Medical Center Way
San Francisco, CA 94143

UNSCANNABLE MEDIA

To use the unscannable media document # 2130566
contact the Region IX Superfund Records Center
at 415-536-2000.